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## ANTHROPOMETRY OF AIRLINE STEWARDESSES

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16. Abstract  This report presents the body measurements of 423 stewardess trainees enrolled in the American Airlines Stewardess Training Academy in Fort Worth, Texas, between February and June 1971. It includes the means, standard deviations, coefficients of variation, percentiles, and related statistics of 72 standard anthropometric and functional measurements. The survey was initiated to provide adequate criteria for improving the emergency equipment availability and workspace design for the stewardess.					
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## ANTHROPOMETRY OF AIRLINE STEWARDESSES

### Introduction.

On November 22, 1964, a TWA Boeing 707 crashed on takeoff at Rome's Fiumicino Airport.<sup>1</sup> In addition to the regular complement of five stewardesses, this flight carried six other TWA stewardesses, five of whom were traveling together to Cairo as a "deadhead" crew; the sixth off-duty stewardess was traveling with her parents on vacation.

After the aircraft skidded to a stop, it was engulfed in flames and, a few seconds later, the cabin was rocked by the explosion of a fuel tank. Approximately 20 seconds after the initial explosion, there was a second and much larger explosion, which killed all passengers and crewmembers still within the cabin and many others already outside but in the immediate vicinity of the aircraft. In this accident, two of the five regular crew stewardesses were killed and the three survivors were seriously injured. All six of the off-duty stewardesses also died. The bodies of five of the off-duty stewardesses were found aboard the aircraft; the sixth stewardess, who was severely burned, died in the hospital 24 hours after the accident. From survivor accounts and from the location of the bodies within the wreckage, it was apparent that most of these stewardesses, including those nominally off duty, died while assisting other passengers to escape.<sup>1</sup>

While this may seem a strange introduction to a report concerned primarily with the body measurements of airline stewardesses, it serves



to emphasize the need to apply the data herein in ways that will help the individual stewardess fulfill the most important of her many duties--that of assisting passengers to evacuate the aircraft during an emergency. The overriding priority of this function of the stewardess is often overlooked by the government, the airlines, and the flying public. To an extent, this attitude is understandable, since a stewardess may serve thousands of meals and drinks during her career yet, fortunately, may never be called upon to exercise her primary responsibility--that of saving lives.

It is in takeoff and landing accidents, which make up a disproportionate number of the total of fatal commercial air crashes,<sup>2</sup> that her training and dedication to duty are most crucial. In such accidents, male crewmembers in the cockpit are exposed to the fullest impact forces and frequently are killed or seriously injured. Even if the male crewmembers are uninjured, emergency routines may require that the pilot and copilot go through involved shutdown procedures to minimize postcrash fire hazards and only the second officer is assigned to immediately assist in the evacuation. Thus, the success or failure of an emergency evacuation, when measured in human lives, depends on the performance of each stewardess. Alone and unassisted, she must manually open exit doors weighing several hundred pounds; deploy escape slides, which can be a complex and tricky procedure; manhandle window exits that weigh almost half as much as she does; and physically assist children or disabled passengers to an exit. To perform these duties in a crisis, she must be superbly trained, physically fit, mentally alert, and, above all, uninjured in the crash itself.

Much effort has been spent in designing safe, comfortable, and efficient seating, restraint, and display systems for pilots. Consequently, commercial air carrier aircraft cockpits are second only to space capsules as monuments to the ingenuity and ability of human engineers to master the complexities of the man-machine interface. The money and effort are well spent, since even a subliminal reduction of pilot stress and fatigue through better design may be rewarded by significant gains in air safety. Yet even within such marvelously designed cockpits, mechanical and human errors still occur and result in that seemingly irreducible number of accidents in which preserving the lives of hundreds of passengers suddenly becomes the immediate responsibility of a few young women. That they can be dedicated and self-sacrificing in fulfilling this responsibility was proved at Rome. However, these qualities are of little value if the stewardesses have already been injured or killed because of poorly designed jump seats, restraint harnesses, or cabin furnishings. Unfortunately, the care and effort expended on the stewardess station has been meager in contrast to that devoted to cockpit design.

Some specific design deficiencies in the flight attendant's station were isolated in a 1970 study conducted by the Steward and Stewardess Division of the Air Line Pilots Association.<sup>3</sup> This study analyzes National Transportation Safety Board statistics on 103 accidents and incidents involving emergency evacuations. All occurred between 1964 and 1970 and involved a total of 471 flight attendants. Of this number,



66 (14.0%) were killed and 89 (18.9%) were seriously injured. Design deficiencies identified in that study as influencing the death or injury rate of flight attendants (hence, the efficiency of passenger evacuation) are quoted:<sup>3</sup>

- "(1) Flight attendant seats are under and next to galley and related equipment which dislodges as a result of inadequate securing mechanisms;
- (2) Flight attendant seats often fold up while occupied;
- (3) Occupied flight attendant seats often detach from the structures to which they are fastened;
- (4) No shoulder harnesses are provided on rear-facing seats and attendants are injured as they are thrown from side to side;
- (5) Many flight attendant seats have no head padding to prevent impact with the solid bulkhead behind them;
- (6) The type of shoulder harness supplied for flight attendants' forward-facing seats on all aircraft is entirely inadequate and frequently causes strangulation, broken shoulders and internal injuries;
- (7) Some seats located in galleys are placed so that when the flight attendant is seated, the 20" access for Type I and II emergency exits is eliminated by the attendant's body;
- (8) Side-facing flight attendant seats are dangerous and have inadequate restraint systems. Also if the flight attendant occupying such a seat is killed or injured and remains in the seat, the 20" access to the exit is blocked;
- (9) Flight attendants have no view of the passenger cabin;
- (10) Flight attendants have no view outside the aircraft;
- (11) Megaphones and flashlights are not quickly accessible from the flight attendant's seat location. In addition, megaphones of excess weight create difficulty."

Not all the faults of poor design are the results of carelessness. Even with the best of intentions, human engineers can design well only for humans they know something about. Until the present study, no data have been available on the body dimensions of the airline stewardesses who, as will be shown below, differ significantly in many respects from other female populations. Lacking adequate anthropometric data, aircraft design engineers have been forced to use data gathered on other female occupational groups, such as WAF recruits, student nurses, and college women.

The object of the present study is to provide anthropometric data that, hopefully, will be applied toward improving the chances of survival of the stewardess and, thus, those of her passengers.

#### The Stewardess Population.

In 1971, the year this survey was conducted, 41,700 stewardesses were employed by 55 airlines based in the United States, Canada, and the Caribbean. The smallest airline (Johnson Flying Service) employed six stewardesses; the largest (United) employed 6,154. Most of the 55 airlines employed fewer than 400 stewardesses. Fourteen major companies employed more than 400 stewardesses, and their combined stewardess complement totaled 35,730, or 85.7 percent of the overall stewardess population.

The criteria used in selecting stewardess trainees varies from airline to airline. In general, each airline selects its applicants on the basis of height, weight, age, education, health, and marital status. Applicants meeting these basic requirements are then evaluated on less tangible attributes, such as personal appearance and personality. Other abilities may also be taken into account by some airlines; for example, those with



extensive overseas routes prefer (and, in some instances, require) that an applicant be fluent in at least one of the foreign languages spoken in the regions served by the airline.

After she is selected, the applicant must undergo a 4- to 6-week training period. Precise statistics are lacking, but estimates by training officials indicate that, in most schools, about 5 percent of the applicants fail to finish training. When her training is completed, the fledgling stewardess is given a base assignment. Thereafter, the length of her stewardess career will depend on many variables. In many cases, disenchantment with the supposedly glamorous life of the airline stewardess sets in early and the stewardess resigns after a few months of service. Marriage is a frequent reason for leaving, although airlines have recently relaxed their rules requiring that stewardesses remain single. Some now allow married stewardesses with children to remain on duty. Other stewardesses who remain with an airline a number of years may find it increasingly difficult to maintain the rather rigid weight requirements and either resign or take other non-flying positions with their companies. Many stewardesses, after several years of on-line duty, are promoted to supervisory, training, or other administrative posts. These factors, plus many others, interact to produce a young population with a high replacement rate.

#### Survey Design.

Ideally, an anthropometric survey should be designed so as to randomly sample the population to be studied. A review of characteristics of the stewardess population, as outlined above, made it obvious that

to obtain such a sample would require an inordinately large travel budget, complex negotiations with many airlines, and a large number of research personnel. Since available resources did not permit such an exhaustive study, the subjects were selected from a single airline with stewardess selection criteria typical of the industry as a whole. After some review (see below), American Airlines seemed to meet most specifications. In 1971, American Airlines employed 4,215 stewardesses, ranking fourth among U. S. domestic carriers in this regard.

Preliminary discussions with American Airlines officials convinced us, however, that a randomized selection of on-line stewardesses would be difficult, since they are currently domiciled in nine U. S. cities, reside in widely scattered areas within each city, and are on such varying flight duties that any reasonable advance scheduling for anthropometrics would be virtually impossible. As a practical alternate, it was suggested that we choose our subjects from trainees at American Airlines Stewardess Training Academy in Fort Worth, Texas.

A disadvantage of using trainees as subjects is that they differ from the airline population in age and those anthropometric variables such as weight and girth measurements that are age dependent. However, considering the high replacement rate within the stewardess population, it was felt that the age differential between trainees and on-line stewardesses would be minimal. Also operative in minimizing post-training anthropometric changes are the rigid weight and hip girth limitations that must be maintained by on-line stewardesses throughout their careers and are identical to those imposed during selection of applicants. From these considerations, it appeared that anthropometric differences between on-line and trainee stewardesses were likely to be negligible.



Stewardess Training Academy officials , when contacted, readily agreed to cooperate by providing space and assistance with stipulations that we not interfere with regular training schedules and that the subjects be volunteers.

A review of training schedules revealed that trainees were free on four weekends during their 6-week training period. Accordingly, anthropometrics were scheduled for Saturdays and Sundays. Since subjects wore bathing suits, problems of taking measurements over clothing were negligible except for one dimension, bust circumference. In this instance, arrangements were made with the clinic nurse to obtain a nude bust circumference on each applicant as she presented herself for a routine chest X-ray. Since a number of subjects had been recently X-rayed prior to training, they were not reexamined and our sample for this measurement was reduced accordingly.

To induce trainees to volunteer for measurement, their instructors explained the purpose of the project to each incoming class. This briefing was supplemented by a form letter in which objectives and procedures of the project were explained in detail. Further inducement was provided by payment of a subject fee of 3 dollars for each volunteer. Of the 763 trainees processed through the training academy in this survey, 423 (55.4%) volunteered for measurements.

Reliance on volunteer subjects raises a question of sample reliability. There is the possibility, for example, that exceptionally tall or short individuals, or those with peculiarities of physique, might be hesitant to expose themselves to anthropometric scrutiny. In the present case, the possibility of such bias was to an extent minimized by the rather

rigid selection of applicants for training, which would have already screened out individuals with extreme physiques or disfigurements.

A further check to discern bias introduced by use of volunteers was accomplished by comparing "first day" heights and weights of the volunteers with those trainees who chose not to be measured. First-day measurements are taken on the initial day of training by the applicants' instructors using an ordinary physician's scale with an attached stadiometer. Weight is recorded to the nearest 0.25 pound and height to the nearest 0.25 inch. Since these measurements were taken independently from our own and before the trainee's decision to volunteer as a subject, any significant difference in first-day measurements between volunteers and nonvolunteers might be taken as evidence that physique-related factors may have influenced their decisions. The first-day height and weight means of volunteers and nonvolunteers are given in Table 1. Students' t-tests of height and weight means and F-tests of the variances showed no significant difference between the two groups. Comparison of the univariate frequency distributions for both height and weight, made by using the Kolmogorov-Smirnov two-sample test,<sup>4</sup> also failed to show statistically significant differences between the volunteers and nonvolunteers. Thus, at least in regard to the two key anthropometric variables of height and weight, our subjects were representative of the 1971 American Airlines stewardess trainees.

#### Methods.

The survey was conducted by a five-member team consisting of two male anthropometrists and three female laboratory assistants. One

TABLE 1

COMPARISON OF FIRST-DAY HEIGHTS AND WEIGHTS OF  
 STEWARDESS TRAINEES WHO VOLUNTEERED FOR  
 ANTHROPOMETRICS WITH THOSE WHO DID NOT VOLUNTEER

	<u>Height (inches)</u>		<u>Weight (pounds)</u>	
	$\bar{x}$	SD	$\bar{x}$	SD
Volunteers (No. = 423)	65.29	1.88	117.56	9.60
Nonvolunteers (No. = 340)	65.32	1.90	118.04	9.99

<u>Comparisons</u>	<u>Method</u>		
Means	t-test	p > 0.10	p > 0.10
Variances	F-test	p > 0.10	p > 0.10
Distributions	Kolmogorov- Smirnov test	p > 0.10	p > 0.10



assistant was assigned to each anthropometrist to record measurements. The third assistant conducted subject interviews and marked the necessary measuring points on each subject. The composition of the team and the duties of its members remained constant throughout the study.

Subjects were processed through three stations. At the first, personal interview data were obtained and anthropometric measuring points applied with a skin-marking pencil. At the second station, sitting and facial measurements were taken. Body weight, standing measurements, girths, and skinfolds were taken at the third station.

All measurements were entered directly on computer data sheets. Body weight was recorded to the nearest pound, and linear measurements were recorded in millimeters. To correct for clothing, 0.25 pound was subtracted from body weight.

Weight was recorded on a calibrated physician's scales. Stature was measured with a Harpenden portable stadiometer. Other linear body measurements were taken with Harpenden anthropometers with digital readout or, where appropriate, with the smaller GPM sliding or spreading caliper. Girths were measured with steel tapes. A Lange caliper was used to obtain skinfolds.

When possible, the measuring techniques used in this survey followed the definitions and measurements defined in the series of anthropometric surveys of USAF personnel <sup>5,6,7</sup> conducted by the Physical Anthropology Section of the U. S. Air Force Research and Development Command.

## Description of Sample.

Age. From the subject's birth date, her age at the time of measurement was computed to the nearest 0.01 year. Figure 1 shows the age distribution of the sample. The range of 19.5 to 27.8 years reflects American Airlines recruiting standards of a minimum of 19.5 years with no maximum but a stated preference for applicants under 28 years of age. The mean age of the 423 subjects was 22.08 years.

Race. Most of the subjects were racially classified by phenotypic examination during anthropometry. In a few doubtful cases, the subject was asked to state her race. Classification was limited to the major racial stocks of white, Negro, and mongoloid--the last including all Orientals and the single American Indian (Choctaw) subject. Of the 423 subjects, 381 (90.1%) were white, 32 (7.6%) were Negro, and 10 (2.3%) were mongoloid.

Birthplace. Of the 423 subjects of this study, 20 (4.73%) were foreign-born. This percentage is slightly lower than that of the U. S. population (5.45%).<sup>8</sup> Birthplaces of the foreign-born subjects are as follows:

Canada	3	Korea	1
West Indies	3	Indonesia	1
Peru	1	Philippines	<u>2</u>
Germany	4	Total	20
Austria	2		
Japan	1		
China	2		

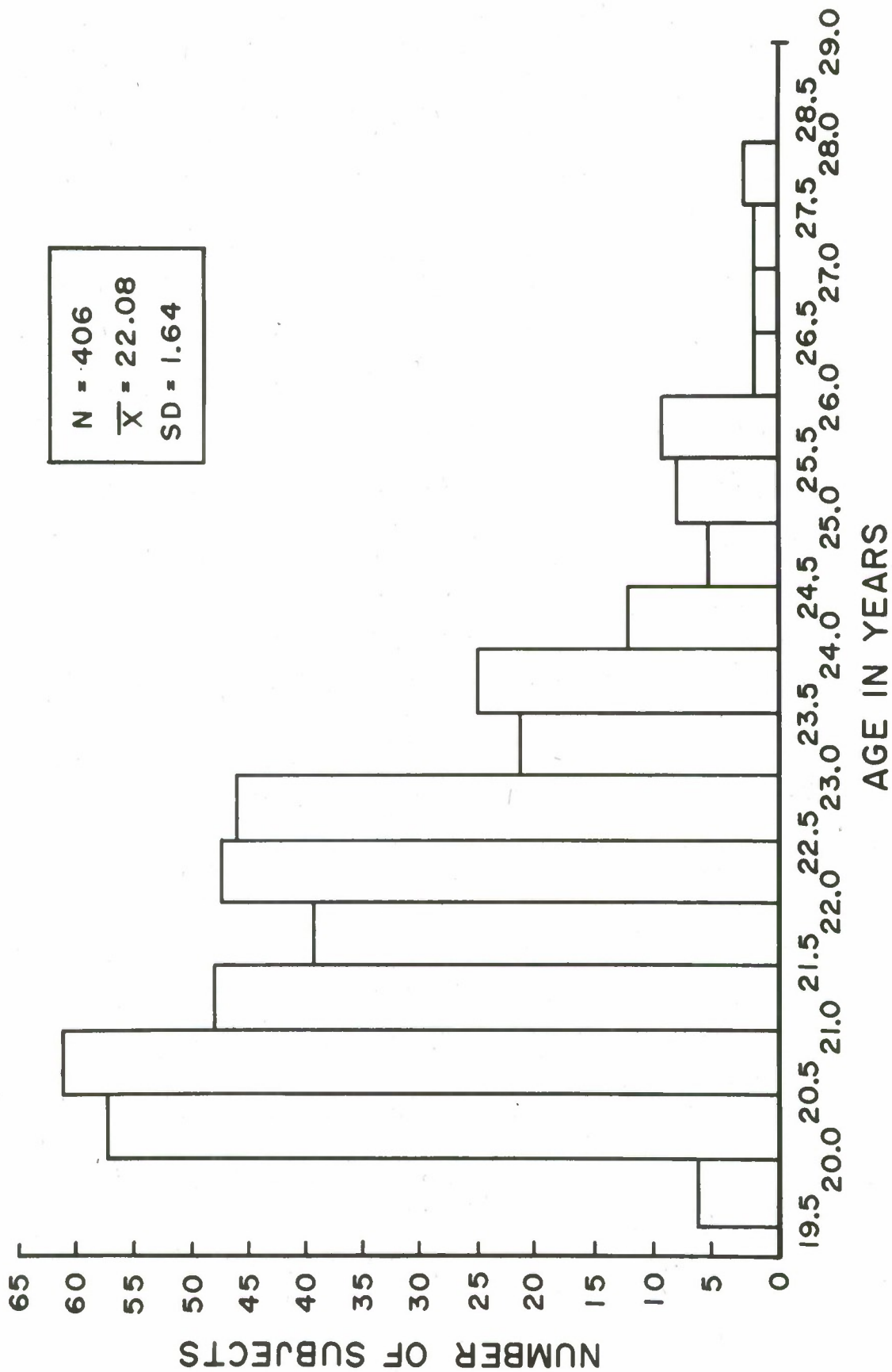


Fig. 1. Age distribution of subjects.



The birthplaces of the 403 United States-born subjects represented all states except Alaska, Nebraska, New Hampshire, Nevada, and Wyoming. Three subjects were of Puerto Rican parentage but were born in New York City. New York (42), Illinois (39), California (36), and Texas (33) were the most frequently listed birthplaces.

In Table 2 the census division (geographical area) distribution of birthplaces of subjects born in the United States is compared to the total number of births occurring in the corresponding census divisions in 1950--the census year closest to the mean birth year of the sample. Compared to general population statistics, the percentage of subjects from the East North Central division is greater by 5.8 percent and the percentage of those from the South Atlantic division is smaller by 6.2 percent. With these exceptions, the sample appears fairly typical of the U. S. population in regard to birthplaces within the United States and the percentage of foreign-born subjects.

Handedness. After the interview, each subject was asked to sign a voucher to obtain her subject fee. Handedness was classified by observing the hand with which the subject wrote her name. Forty-three (10.2%) of the subjects were classified as left handed.

Marital Status. Applicants for American Airlines stewardess training must be single. Of the 423 subjects, 26 (6.1%) stated that they had been married.

Education. The minimum education requirement for acceptance as an American Airlines stewardess trainee is a high school diploma or an equivalent General Education Development rating issued by the state in which the applicant resides. Among the trainees measured in this study,

TABLE 2

DISTRIBUTION OF BIRTHPLACES OF UNITED STATES-BORN  
SUBJECTS COMPARED TO CENSUS DIVISION DISTRIBUTION  
OF BIRTHS OF U. S. POPULATION IN 1950

Birthplace	No.	Percent of Sample	Percent U.S. Births 1950	Difference
NEW ENGLAND (Conn., Maine, Mass., N. H., R. I., Vt.)	32	7.9	5.4	2.5
MIDDLE ATLANTIC (N. Y., N. J., Pa.)	77	19.1	17.2	1.9
EAST NORTH CENTRAL (Ohio, Ind., Ill., Mich., Wisc.)	103	25.6	19.8	5.8
WEST NORTH CENTRAL (Minn., Iowa, Mo., N. Dak., S. Dak., Nebr., Kans.)	24	5.9	9.3	-3.4
SOUTH ATLANTIC (Del., Md., D. C., Va., W. Va., N. C., S. C., Ga., Fla.)	37	9.2	15.4	-6.2
EAST SOUTH CENTRAL (Ky., Tenn., Ala., Miss.)	29	7.2	8.7	-1.5
WEST SOUTH CENTRAL (Ark., La., Okla., Tex.)	45	11.2	10.9	0.3
MOUNTAIN (Mont., Idaho, Wyo., Colo., N. Mex., Ariz., Utah, Nev.)	13	3.2	4.0	-0.8
PACIFIC (Wash., Oreg., Calif., Alaska, Hawaii)	43	10.7	9.4	1.3

about 89 percent had some post-high-school education (Table 3). For about 13 percent of the latter group, this education consisted of vocational training, such as business or technical schools. The remaining 76 percent had completed at least one semester of college. Almost one-fourth (23.5%) of the sample had earned bachelor's degrees. Five subjects had undertaken graduate work and, of these, one had received her Master's Degree in Education.

#### Anthropometric Data.

The measurements taken in this study are listed in Table 4 and presented in tabular form on the following pages. The definition of each measurement (except body weight) is supplemented by an illustration useful in providing a visual guide to the landmarks and method used in taking it. Due to technical limitations, some of the illustrations do not reflect exactly the actual position of the subject. For example, in taking anterior thigh skinfold (page 27), the subject was asked to stand with her left leg slightly flexed instead of fully erect, as shown in the drawing. Therefore, the definition, not the drawing, should be used as final arbiter in resolving any apparent conflict between the two.

Following the definition, the basic statistics for each measurement are presented in the metric and English units. Since the measurements were recorded in metric units and converted to English units, second-decimal discrepancies between the two are due to rounding errors in the English system units. For this reason, the metric measurements should be used in computations where second-decimal accuracy is required.



TABLE 3

LEVEL AND TYPE OF EDUCATION OF  
ANTHROPOMETRIC SAMPLE (No. - 422)

Education	Number	Percent of Sample
<u>High School Only</u>	46	10.9
<u>Post High School</u>		
Vocational:		
Business	18	4.3
Paramedical	10	2.4
Fashion-Merchandizing	21	4.9
Arts	2	0.5
Other	5	1.2
Total	56	13.3
University:		
Freshman	70	16.6
Sophomore	95	22.5
Junior	40	9.5
Senior, no degree	11	2.6
Senior, bachelor's degree	99	23.5
Graduate school, no degree	4	0.9
Graduate school, master's degree	1	0.2
Total	320	75.8

The single exception to this is body weight (page 23), which was recorded in pounds and converted to kilograms.

The statistics reported are those basic to any standard anthropometric survey: sample size, mean, standard deviation (the two latter measurements with their appropriate standard errors), the minimum and maximum values observed, the coefficient of variation, and, finally, a table of percentiles. The latter are the traditional parameters employed by human engineers in designing equipment to fit user populations.

Since the primary purpose of this paper is to present the findings in a form useful to basic design engineering, much secondary data of interest to physical anthropologists and human biologists has been omitted. For example, we have not calculated the traditional indices employed by physical anthropologists to study body proportions. The authors plan to follow the present publication with one or more subsequent monographs dealing with these topics. Meanwhile, it is hoped that the data given here will be found useful in providing safer and better designed crew stations and equipment so that stewardesses may better serve--and protect--their passengers.

TABLE 4

## LIST OF MEASUREMENTS

	<u>Page</u>
Acromial height	28
Acromial height, sitting	38
Ankle breadth, bimalleolar	84
Ankle circumference	57
Arm circumference, forearm	60
Arm circumference, upper, extended	59
Arm circumference, upper, flexed	58
Arm reach, horizontal	46
Arm reach, maximum overhead, sitting	47
Biacromial breadth	62
Bideltoid breadth	63
Bigonial breadth	89
Bimalleolar breadth	84
Bitrochanteric breadth	69
Bizygomatic breadth	88
Bust circumference	50
Buttocks depth	78
Buttock-knee length	42
Buttock-popliteal length	43
Calf circumference	56
Calf skinfold	26
Chest breadth	64
Chest circumference, expiration	52
Chest circumference, inspiration	51
Chest depth	76
Dactylion height	33
Elbow breadth, humeral epicondylar	73
Elbow-elbow breadth	71
Elbow-hand length	45
Elbow resting height	39
Eye height, sitting	37
Face breadth, bigonial	89
Face breadth, bizygomatic	88
Face height, total	90
Femoral bicondylar breadth	75
Foot breadth	83
Foot length	82
Forearm circumference	60
Hand breadth	81
Hand length	79
Head breadth	86
Head breadth, minimum frontal	87

	<u>Page</u>
Head length	85
Hip breadth, sitting	70
Hip breadth, standing	68
Hip circumference	54
Humeral epicondylar breadth	73
Iliocristale breadth	66
Iliospinale breadth	67
Iliospinale height	31
Knee height	34
Knee height, sitting	40
Knee-knee breadth, sitting	72
Nasal breadth	92
Nasal height	91
Neck circumference	48
Palm length	80
Popliteal height, sitting	41
Radiale height	30
Shoulder breadth, biacromial	62
Shoulder breadth, bideltoid	63
Shoulder circumference	49
Shoulder-elbow length	44
Sitting height	36
Sphyrion height	35
Stature	27
Stylion height	32
Subscapular skinfold	22
Suprailiac skinfold	24
Suprasternal height	29
Thigh circumference	55
Thigh skinfold	25
Triceps skinfold	23
Waist breadth	65
Waist circumference	53
Waist depth	77
Weight	21
Wrist breadth	74
Wrist circumference	61



# WEIGHT

Subject's weight to the nearest pound as recorded on standard medical scales.

N 422

MEAN	116.42 $\pm$ 0.46 LB.	52.81 $\pm$ 0.21 KG.
S.D.	9.39 $\pm$ 0.32 LB.	4.26 $\pm$ 0.15 KG.
MINIMUM	94.00 LB.	42.64 KG.
MAXIMUM	145.00 LB.	65.77 KG.
C.V.	8.07 %	8.07 %

	LB.	KG.
	1 98.78	44.81
	2 99.98	45.35
	3 100.89	45.76
	5 102.30	46.40
	10 104.83	47.55
	15 106.76	48.43
P	20 108.41	49.17
E	25 109.91	49.85
R	30 111.30	50.48
C	35 112.62	51.09
E	40 113.91	51.67
N	45 115.18	52.25
T	50 116.46	52.83
I	55 117.76	53.42
L	60 119.08	54.02
E	65 120.46	54.64
S	70 121.92	55.30
	75 123.50	56.02
	80 125.26	56.82
	85 127.26	57.73
	90 129.74	58.85
	95 133.18	60.41
	97 135.23	61.34
	98 136.61	61.97
	99 138.54	62.84

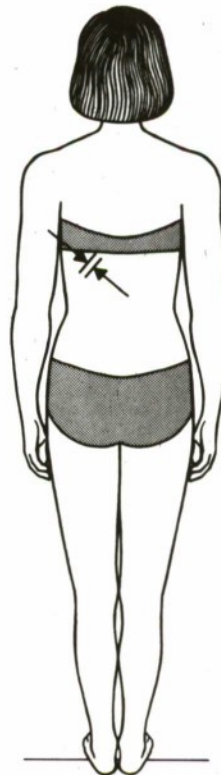
## SUBSCAPULAR SKINFOLD

Subject stands erect with arms hanging relaxed at her sides. Using the Lange skinfold caliper, measure the thickness of the skinfold immediately below the inferior angle of the left scapula and parallel to the tension lines of the skin.

N 407

MEAN	9.04 $\pm$ 0.11 MM.	0.36 $\pm$ 0.00 IN.
S.D.	2.27 $\pm$ 0.08 MM.	0.09 $\pm$ 0.00 IN.
MINIMUM	4.70 MM.	0.19 IN.
MAXIMUM	20.90 MM.	0.82 IN.
C.V.	25.08 %	25.08 %

	MM.	IN.
	1 5.17	0.20
	2 5.58	0.22
	3 5.83	0.23
	5 6.16	0.24
	10 6.67	0.26
	15 7.03	0.28
P	20 7.32	0.29
E	25 7.58	0.30
R	30 7.82	0.31
C	35 8.06	0.32
E	40 8.30	0.33
N	45 8.53	0.34
T	50 8.78	0.35
I	55 9.04	0.36
L	60 9.31	0.37
E	65 9.61	0.38
S	70 9.94	0.39
	75 10.32	0.41
	80 10.78	0.42
	85 11.34	0.45
	90 12.12	0.48
	95 13.41	0.53
	97 14.34	0.56
	98 15.09	0.59
	99 16.35	0.64



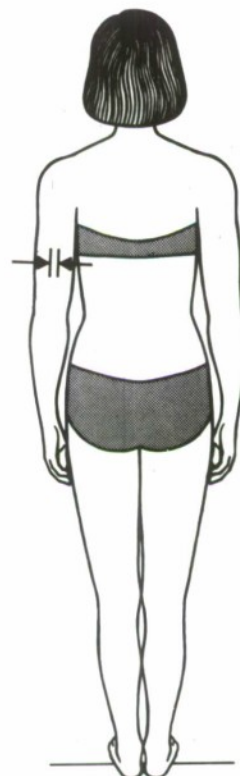
# TRICEPS SKINFOLD

Subject stands erect with right elbow flexed at 90°. At the point on the posterior surface of the upper arm halfway between the acromion and the tip of the elbow, pick up a skinfold parallel to the long axis of the arm. The subject is then allowed to extend her arm relaxed to her side and the skinfold measurement is taken with a Lange caliper.

N 421

MEAN	14.36 $\pm$ 0.16 MM.	0.57 $\pm$ 0.01 IN.
S.D.	3.33 $\pm$ 0.11 MM.	0.13 $\pm$ 0.00 IN.
MINIMUM	5.50 MM.	0.22 IN.
MAXIMUM	25.30 MM.	1.00 IN.
C.V.	23.20 %	23.20 %

		MM.	IN.
	1	7.75	0.31
	2	8.53	0.34
	3	8.98	0.35
	5	9.56	0.38
	10	10.44	0.41
	15	11.04	0.43
P	20	11.55	0.45
E	25	12.00	0.47
R	30	12.43	0.49
C	35	12.83	0.51
E	40	13.24	0.52
N	45	13.65	0.54
T	50	14.07	0.55
I	55	14.50	0.57
L	60	14.95	0.59
E	65	15.44	0.61
S	70	15.96	0.63
	75	16.55	0.65
	80	17.22	0.68
	85	18.01	0.71
	90	19.02	0.75
	95	20.51	0.81
	97	21.43	0.84
	98	22.07	0.87
	99	22.98	0.90



# SUPRAILAC SKINFOLD

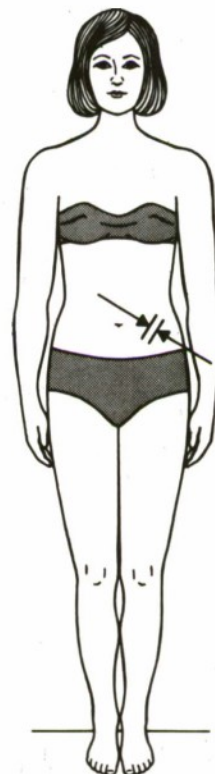
Subject stands erect with abdomen relaxed. Using the Lange skinfold caliper, measure the thickness of the skinfold approximately 1 cm above and 2 cm medial to the anterior superior iliac spine.

N 376

MEAN	9.91 ± 0.18 MM.	0.39 ± 0.01 IN.
S.D.	3.56 ± 0.13 MM.	0.14 ± 0.01 IN.
MINIMUM	3.00 MM.	0.12 IN.
MAXIMUM	23.50 MM.	0.93 IN.
C.V.	35.94 %	35.94 %

	MM.	IN.
1	4.27	0.17
2	4.61	0.18
3	4.86	0.19
5	5.24	0.21
10	5.93	0.23
15	6.47	0.25
20	6.95	0.27
25	7.39	0.29
30	7.82	0.31
35	8.23	0.32
40	8.65	0.34
45	9.07	0.36
50	9.51	0.37
55	9.96	0.39
60	10.43	0.41
65	10.94	0.43
70	11.50	0.45
75	12.13	0.48
80	12.86	0.51
85	13.74	0.54
90	14.90	0.59
95	16.71	0.66
97	17.93	0.71
98	18.84	0.74
99	20.31	0.80

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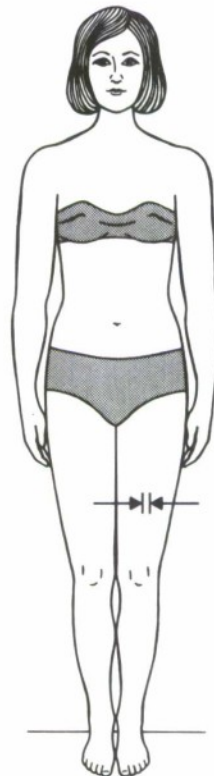
# ANTERIOR THIGH SKINFOLD

Subject stands with left leg slightly flexed. Using the Lange skinfold caliper, measure the thickness of the skinfold at the anterior midline of the level marked for thigh circumference.

N 400

MEAN	19.67 $\pm$ 0.22 MM.	0.77 $\pm$ 0.01 IN.
S.D.	4.48 $\pm$ 0.16 MM.	0.18 $\pm$ 0.01 IN.
MINIMUM	4.00 MM.	0.16 IN.
MAXIMUM	33.00 MM.	1.30 IN.
C.V.	22.75 %	22.75 %

	MM.	IN.
	1 9.88	0.39
	2 11.26	0.44
	3 12.04	0.47
	5 13.02	0.51
	10 14.40	0.57
	15 15.31	0.60
P	20 16.03	0.63
E	25 16.68	0.66
R	30 17.27	0.68
C	35 17.83	0.70
E	40 18.38	0.72
N	45 18.93	0.75
T	50 19.49	0.77
I	55 20.07	0.79
L	60 20.68	0.81
E	65 21.32	0.84
S	70 22.02	0.87
	75 22.79	0.90
	80 23.67	0.93
	85 24.71	0.97
	90 26.04	1.03
	95 27.96	1.10
	97 29.14	1.15
	98 29.94	1.18
	99 31.05	1.22



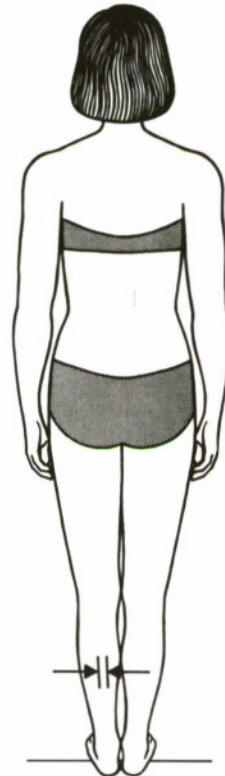
## POSTERIOR CALF SKINFOLD

Subject stands with left leg relaxed and slightly flexed. Using the Lange skinfold caliper, measure the thickness of the skinfold at the posterior midline of the calf at the level of maximum circumference.

N 178

MEAN	15.48 $\pm$ 0.23 MM.	0.61 $\pm$ 0.01 IN.
S.D.	3.10 $\pm$ 0.16 MM.	0.12 $\pm$ 0.01 IN.
MINIMUM	7.50 MM.	0.30 IN.
MAXIMUM	24.50 MM.	0.96 IN.
C.V.	20.02 %	20.02 %

	MM.	IN.
	1 8.76	0.34
	2 9.46	0.37
	3 9.94	0.39
	5 10.60	0.42
	10 11.66	0.46
	15 12.39	0.49
P	20 12.98	0.51
E	25 13.49	0.53
R	30 13.94	0.55
C	35 14.36	0.57
E	40 14.76	0.58
N	45 15.15	0.60
T	50 15.54	0.61
I	55 15.92	0.63
L	60 16.31	0.64
E	65 16.72	0.66
S	70 17.15	0.68
	75 17.62	0.69
	80 18.15	0.71
	85 18.78	0.74
	90 19.59	0.77
	95 20.84	0.82
	97 21.70	0.85
	98 22.37	0.88
	99 23.48	0.92



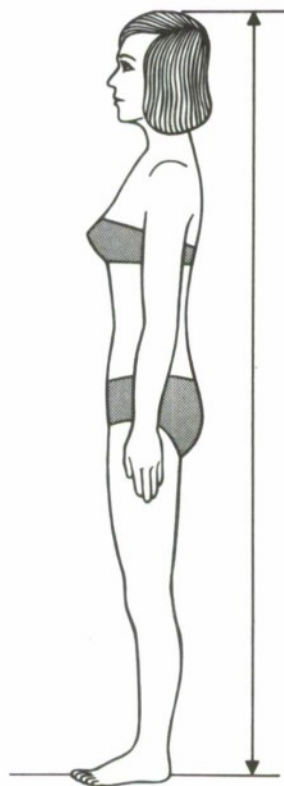
## STATURE

Subject stands with heels together, back straight, head in horizontal plane defined by line from trasion to bottom of bony orbit. Bring the counterweighted board of the Harpenden stadiometer into firm contact with vertex.

N 422

MEAN	166.25 $\pm$ 0.24 CM.	65.45 $\pm$ 0.09 IN.
S.D.	4.85 $\pm$ 0.17 CM.	1.91 $\pm$ 0.07 IN.
MINIMUM	155.50 CM.	61.22 IN.
MAXIMUM	179.40 CM.	70.63 IN.
C.V.	2.91 %	2.91 %

	CM.	IN.
P E R C E N T I L E S	1 157.10	61.85
	2 157.62	62.05
	3 158.05	62.22
	5 158.74	62.50
	10 160.04	63.01
	15 161.04	63.40
	20 161.90	63.74
	25 162.68	64.05
	30 163.40	64.33
	35 164.09	64.60
	40 164.76	64.86
	45 165.41	65.12
	50 166.07	65.38
	55 166.74	65.64
	60 167.42	65.91
	65 168.12	66.19
	70 168.87	66.48
	75 169.68	66.80
	80 170.58	67.16
	85 171.62	67.57
	90 172.91	68.08
	95 174.77	68.81
	97 175.92	69.26
	98 176.74	69.58
	99 177.95	70.06



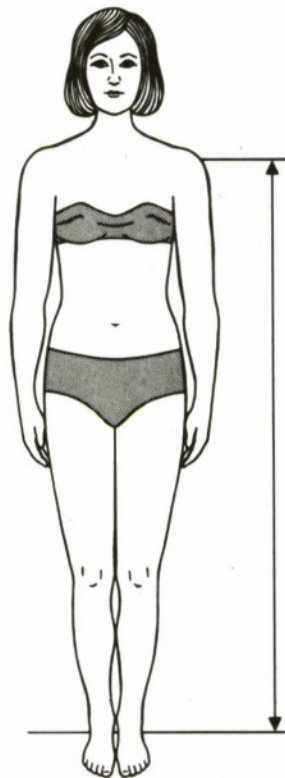
## ACROMIAL HEIGHT

Subject stands erect. Using the anthropometer, measure the vertical distance from the floor to the left acromiale.

N 422

MEAN	135.18 $\pm$ 0.23 CM.	53.22 $\pm$ 0.09 IN.
S.D.	4.65 $\pm$ 0.16 CM.	1.83 $\pm$ 0.06 IN.
MINIMUM	124.70 CM.	49.09 IN.
MAXIMUM	149.10 CM.	58.70 IN.
C.V.	3.44 %	3.44 %

	CM.	IN.
	1 125.97	49.59
	2 126.44	49.78
	3 126.89	49.96
	5 127.64	50.25
	10 129.05	50.81
	15 130.13	51.23
P	20 131.03	51.59
E	25 131.84	51.91
R	30 132.57	52.19
C	35 133.26	52.47
E	40 133.92	52.72
N	45 134.55	52.97
T	50 135.18	53.22
I	55 135.81	53.47
L	60 136.44	53.71
E	65 137.08	53.97
S	70 137.76	54.24
	75 138.49	54.52
	80 139.29	54.84
	85 140.21	55.20
	90 141.37	55.66
	95 143.08	56.33
	97 144.21	56.78
	98 145.07	57.11
	99 146.47	57.67





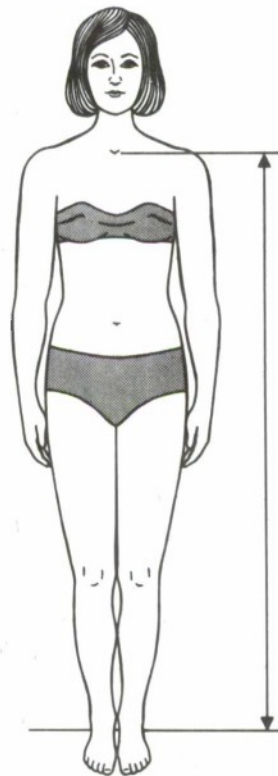
# SUPRASTERNAL HEIGHT

Subject stands erect. Using the anthropometer, measure the vertical distance from the floor to suprasternale.

N 422

MEAN	134.59 $\pm$ 0.21 CM.	52.99 $\pm$ 0.08 IN.
S.D.	4.34 $\pm$ 0.15 CM.	1.71 $\pm$ 0.06 IN.
MINIMUM	124.90 CM.	49.17 IN.
MAXIMUM	147.50 CM.	58.07 IN.
C.V.	3.22 %	3.22 %

	CM.	IN.
	1 126.50	49.80
	2 126.79	49.92
	3 127.12	50.05
	5 127.73	50.29
	10 128.94	50.76
	15 129.89	51.14
P	20 130.70	51.46
E	25 131.44	51.75
R	30 132.11	52.01
C	35 132.74	52.26
E	40 133.35	52.50
N	45 133.94	52.73
T	50 134.52	52.96
I	55 135.11	53.19
L	60 135.70	53.43
E	65 136.31	53.67
S	70 136.95	53.92
	75 137.64	54.19
	80 138.41	54.49
	85 139.29	54.84
	90 140.39	55.27
	95 142.05	55.92
	97 143.14	56.36
	98 143.97	56.68
	99 145.33	57.22



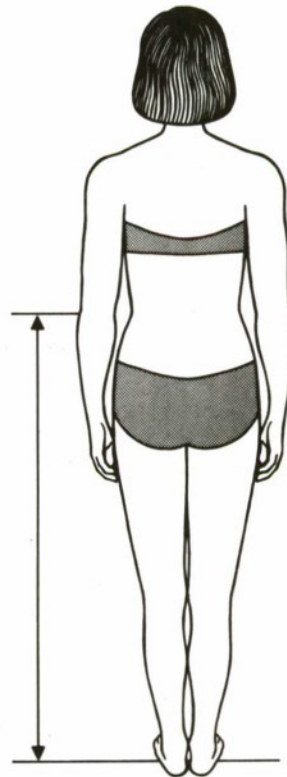
## RADIALE HEIGHT

Subject stands erect with arms hanging naturally at her sides. Using the anthropometer, measure the vertical distance from the floor to the left radiale.

N 422

MEAN	104.30 $\pm$ 0.18 CM.	41.06 $\pm$ 0.07 IN.
S.D.	3.78 $\pm$ 0.13 CM.	1.49 $\pm$ 0.05 IN.
MINIMUM	94.70 CM.	37.28 IN.
MAXIMUM	133.30 CM.	52.48 IN.
C.V.	3.63 %	3.63 %

	CM.	IN.
	1 96.46	37.98
	2 97.02	38.20
	3 97.46	38.37
	5 98.14	38.64
	10 99.35	39.12
	15 100.25	39.47
P	20 100.98	39.76
E	25 101.63	40.01
R	30 102.22	40.24
C	35 102.77	40.46
E	40 103.29	40.67
N	45 103.80	40.86
T	50 104.30	41.06
I	55 104.79	41.26
L	60 105.30	41.45
E	65 105.81	41.66
S	70 106.36	41.87
	75 106.94	42.10
	80 107.60	42.36
	85 108.35	42.66
	90 109.31	43.03
	95 110.75	43.60
	97 111.72	43.98
	98 112.46	44.28
	99 113.68	44.76



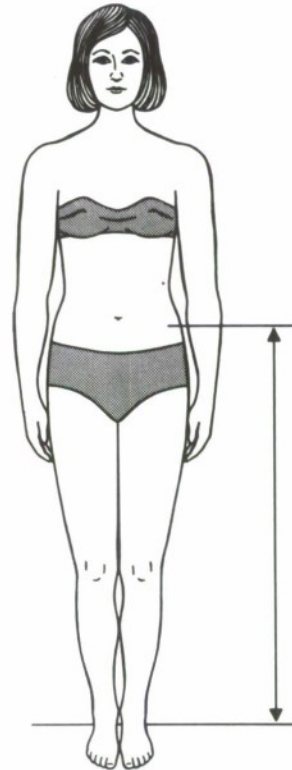
# ILIOSPINALE HEIGHT

Subject stands erect. Using the anthropometer, measure the vertical distance from the floor to the left iliospinale.

N 422

MEAN	92.84 $\pm$ 0.19 CM.	36.55 $\pm$ 0.07 IN.
S.D.	3.88 $\pm$ 0.13 CM.	1.53 $\pm$ 0.05 IN.
MINIMUM	82.90 CM.	32.64 IN.
MAXIMUM	106.60 CM.	41.97 IN.
C.V.	4.18 %	4.18 %

	CM.	IN.
	84.78	33.38
	85.43	33.64
	85.93	33.83
	86.67	34.12
	87.94	34.62
	88.85	34.98
P	89.59	35.27
E	90.24	35.53
R	90.82	35.75
C	91.35	35.97
E	91.87	36.17
N	92.36	36.36
T	92.84	36.55
I	93.33	36.74
L	93.82	36.94
E	94.32	37.13
S	94.85	37.34
	95.43	37.57
	96.08	37.83
	96.84	38.13
	97.83	38.51
	99.37	39.12
	100.46	39.55
	101.31	39.89
	102.77	40.46



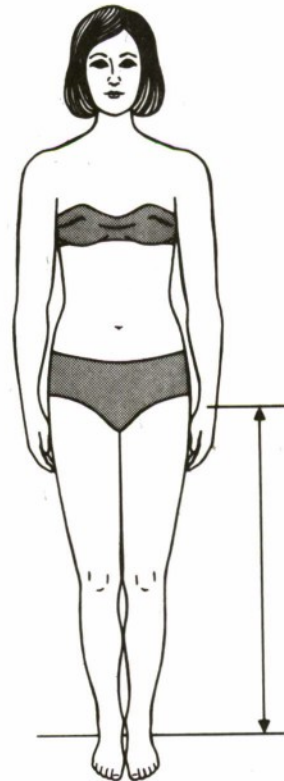
# STYLION HEIGHT

Subject stands erect with arms hanging naturally at her sides. Using the anthropometer, measure the vertical distance from the floor to the left stylium.

N 422

MEAN	81.16 $\pm$ 0.16 CM.	31.95 $\pm$ 0.06 IN.
S.D.	3.37 $\pm$ 0.12 CM.	1.33 $\pm$ 0.05 IN.
MINIMUM	72.20 CM.	28.43 IN.
MAXIMUM	90.60 CM.	35.67 IN.
C.V.	4.15 %	4.15 %

	CM.	IN.	
1	73.90	29.09	
2	74.56	29.35	
3	75.03	29.54	
5	75.72	29.81	
10	76.87	30.26	
15	77.68	30.58	
P	20	78.33	30.84
E	25	78.90	31.06
R	30	79.42	31.27
C	35	79.89	31.45
E	40	80.34	31.63
N	45	80.78	31.80
T	50	81.21	31.97
I	55	81.64	32.14
L	60	82.08	32.31
E	65	82.53	32.49
S	70	83.00	32.68
	75	83.52	32.88
	80	84.10	33.11
	85	84.79	33.38
	90	85.67	33.73
	95	87.04	34.27
	97	87.99	34.64
	98	88.73	34.93
	99	89.97	35.42





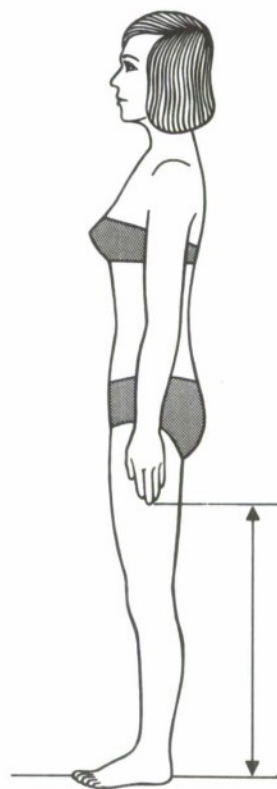
# DACTYLION HEIGHT

Subject stands erect with arms and hands extended at her sides. Using the anthropometer, measure the vertical distance from the floor to the tip of the extended left middle finger.

N 422

MEAN	63.95 $\pm$ 0.15 CM.	25.18 $\pm$ 0.06 IN.
S.D.	3.18 $\pm$ 0.11 CM.	1.25 $\pm$ 0.04 IN.
MINIMUM	53.60 CM.	21.10 IN.
MAXIMUM	74.30 CM.	29.25 IN.
C.V.	4.97 %	4.97 %

	CM.	IN.
	1 56.66	22.31
	2 57.56	22.66
	3 58.12	22.88
	5 58.86	23.17
	10 59.99	23.62
	15 60.75	23.92
P	20 61.34	24.15
E	25 61.86	24.35
R	30 62.32	24.53
C	35 62.74	24.70
E	40 63.15	24.86
N	45 63.55	25.02
T	50 63.94	25.17
I	55 64.33	25.33
L	60 64.74	25.49
E	65 65.16	25.65
S	70 65.60	25.83
	75 66.09	26.02
	80 66.64	26.24
	85 67.29	26.49
	90 68.13	26.82
	95 69.40	27.32
	97 70.25	27.66
	98 70.89	27.91
	99 71.91	28.31



# KNEE HEIGHT

Subject stands erect. Using the anthropometer, measure the vertical distance from the floor to the left tibiale.

N 422

MEAN 43.43  $\pm$  0.10 CM. 17.10  $\pm$  0.04 IN.

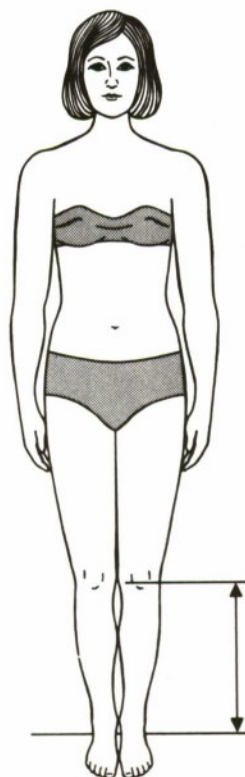
S.D. 2.11  $\pm$  0.07 CM. 0.83  $\pm$  0.03 IN.

MINIMUM 37.20 CM. 14.65 IN.

MAXIMUM 49.80 CM. 19.61 IN.

C.V. 4.86 % 4.86 %

		CM.	IN.
P E R C E N T I L E S	1	39.00	15.35
	2	39.46	15.54
	3	39.76	15.65
	5	40.17	15.81
	10	40.82	16.07
	15	41.28	16.25
	20	41.65	16.40
	25	41.98	16.53
	30	42.28	16.65
	35	42.56	16.76
	40	42.84	16.87
	45	43.11	16.97
	50	43.38	17.08
	55	43.65	17.19
	60	43.94	17.30
	65	44.23	17.41
	70	44.54	17.54
	75	44.89	17.67
	80	45.27	17.82
	85	45.72	18.00
	90	46.29	18.23
	95	47.13	18.56
	97	47.66	18.76
	98	48.04	18.91
	99	48.61	19.14



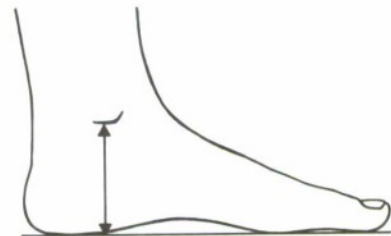
# SPHYRION HEIGHT

Subject stands erect with feet approximately 12 inches apart and left foot slightly forward. Holding the fixed branch of the sliding caliper in contact and parallel to the floor, measure the vertical height of the sphyrion with the movable branch.

N 420

MEAN	6.89 $\pm$ 0.03 CM.	2.71 $\pm$ 0.01 IN.
S.D.	0.61 $\pm$ 0.02 CM.	0.24 $\pm$ 0.01 IN.
MINIMUM	5.20 CM.	2.05 IN.
MAXIMUM	8.70 CM.	3.43 IN.
C.V.	8.86 %	8.86 %

		CM.	IN.
	1	5.47	2.15
	2	5.63	2.22
	3	5.73	2.26
	5	5.87	2.31
	10	6.08	2.40
	15	6.23	2.45
P	20	6.35	2.50
E	25	6.45	2.54
R	30	6.54	2.58
C	35	6.63	2.61
E	40	6.71	2.64
N	45	6.79	2.67
T	50	6.87	2.71
I	55	6.96	2.74
L	60	7.04	2.77
E	65	7.13	2.81
S	70	7.22	2.84
	75	7.32	2.88
	80	7.43	2.92
	85	7.55	2.97
	90	7.71	3.04
	95	7.94	3.13
	97	8.08	3.18
	98	8.18	3.22
	99	8.31	3.27



# SITTING HEIGHT

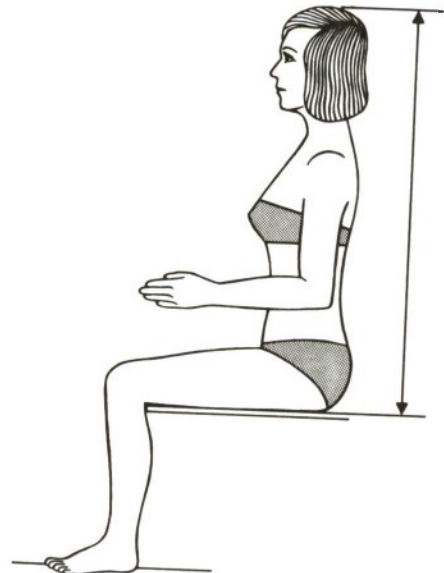
Subject sits erect with head in the Frankfort plane and feet resting lightly on footrest. Using the anthropometer with its arm firmly touching the scalp, measure vertically from the sitting surface to the top of the head.

N 419

MEAN	87.05 $\pm$ 0.14 CM.	34.27 $\pm$ 0.05 IN.
S.D.	2.81 $\pm$ 0.10 CM.	1.11 $\pm$ 0.04 IN.
MINIMUM	79.10 CM.	31.14 IN.
MAXIMUM	96.60 CM.	38.03 IN.
C.V.	3.22 %	3.22 %

	CM.	IN.
1	80.52	31.70
2	81.23	31.98
3	81.71	32.17
5	82.38	32.43
10	83.44	32.85
15	84.16	33.14
20	84.73	33.36
25	85.22	33.55
30	85.65	33.72
35	86.05	33.88
40	86.42	34.02
45	86.78	34.16
50	87.13	34.30
55	87.47	34.44
60	87.82	34.57
65	88.18	34.72
70	88.55	34.86
75	88.96	35.02
80	89.42	35.20
85	89.95	35.41
90	90.64	35.69
95	91.72	36.11
97	92.48	36.41
98	93.07	36.64
99	94.09	37.04

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# EYE HEIGHT, SITTING

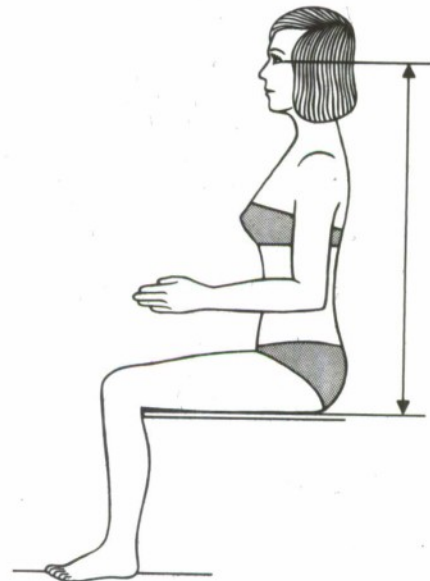
Subject sits erect with head in the Frankfort plane and feet resting lightly on footrest. Using the anthropometer, measure the vertical distance from the sitting surface to the outer corner of the left eye.

N 423

MEAN	76.00 $\pm$ 0.13 CM.	29.92 $\pm$ 0.05 IN.
S.D.	2.75 $\pm$ 0.09 CM.	1.08 $\pm$ 0.04 IN.
MINIMUM	68.70 CM.	27.05 IN.
MAXIMUM	86.30 CM.	33.98 IN.
C.V.	3.62 %	3.62 %

	CM.	IN.
	69.47	27.35
	70.28	27.67
	70.79	27.87
	71.47	28.14
	72.50	28.54
	73.19	28.81
	73.73	29.03
	74.19	29.21
	74.60	29.37
	74.99	29.52
	75.35	29.66
	75.70	29.80
	76.04	29.94
	76.39	30.07
	76.74	30.21
	77.10	30.35
	77.48	30.50
	77.90	30.67
	78.36	30.85
	78.89	31.06
	79.57	31.33
	80.58	31.72
	81.22	31.98
	81.70	32.17
	82.44	32.46

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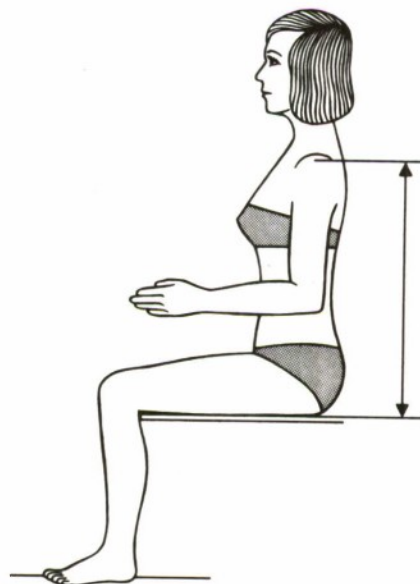
# ACROMIAL HEIGHT, SITTING

Subject sits erect with feet resting lightly on footrest, upper arms hanging at her sides, and lower arms extended horizontally. Using the anthropometer, measure the vertical distance from the sitting surface to the left acromiale.

N 423

MEAN	57.14 $\pm$ 0.12 CM.	22.50 $\pm$ 0.05 IN.
S.D.	2.56 $\pm$ 0.09 CM.	1.01 $\pm$ 0.03 IN.
MINIMUM	49.30 CM.	19.41 IN.
MAXIMUM	66.30 CM.	26.10 IN.
C.V.	4.48 %	4.48 %

		CM.	IN.
P E R C E N T I L E S	1	51.32	20.20
	2	51.80	20.40
	3	52.17	20.54
	5	52.74	20.76
	10	53.70	21.14
	15	54.38	21.41
	20	54.93	21.63
	25	55.41	21.81
	30	55.83	21.98
	35	56.22	22.14
	40	56.59	22.28
	45	56.94	22.42
	50	57.27	22.55
	55	57.61	22.68
	60	57.94	22.81
	65	58.27	22.94
	70	58.62	23.08
	75	58.98	23.22
	80	59.38	23.38
	85	59.83	23.56
	90	60.40	23.78
	95	61.23	24.11
	97	61.79	24.33
	98	62.22	24.50
	99	62.94	24.78



# ELBOW RESTING HEIGHT

Subject sits erect with feet resting lightly on footrest, upper arms hanging at her sides, and lower arms extended forward horizontally. Using the anthropometer, measure the vertical distance from the sitting surface to the lowest bony point at the tip of the left elbow.

N 423

MEAN	24.06 $\pm$ 0.12 CM.	9.47 $\pm$ 0.05 IN.
S.D.	2.52 $\pm$ 0.09 CM.	0.99 $\pm$ 0.03 IN.
MINIMUM	16.30 CM.	6.42 IN.
MAXIMUM	31.00 CM.	12.20 IN.
C.V.	10.49 %	10.49 %

	CM.	IN.
	1 17.60	6.93
	2 18.40	7.24
	3 18.91	7.45
	5 19.62	7.72
	10 20.71	8.15
	15 21.43	8.44
P	20 21.99	8.66
E	25 22.47	8.85
R	30 22.88	9.01
C	35 23.26	9.16
E	40 23.62	9.30
N	45 23.95	9.43
T	50 24.28	9.56
I	55 24.59	9.68
L	60 24.91	9.81
E	65 25.22	9.93
S	70 25.55	10.06
	75 25.90	10.20
	80 26.27	10.34
	85 26.69	10.51
	90 27.21	10.71
	95 27.94	11.00
	97 28.40	11.18
	98 28.73	11.31
	99 29.26	11.52



## KNEE HEIGHT, SITTING

Subject sits erect with feet resting on a surface adjusted so that the knees are bent at about right angles. Using the anthropometer, measure the vertical distance from the footrest surface to the top of the left knee.

N 423

MEAN	51.91 $\pm$ 0.11 CM.	20.44 $\pm$ 0.04 IN.
S.D.	2.24 $\pm$ 0.08 CM.	0.88 $\pm$ 0.03 IN.
MINIMUM	41.20 CM.	16.22 IN.
MAXIMUM	58.70 CM.	23.11 IN.
C.V.	4.31 %	4.31 %

	CM.	IN.
1	46.81	18.43
2	47.48	18.69
3	47.88	18.85
5	48.41	19.06
10	49.20	19.37
15	49.73	19.58
20	50.14	19.74
25	50.50	19.88
30	50.82	20.01
35	51.12	20.12
40	51.40	20.24
45	51.68	20.35
50	51.95	20.45
55	52.23	20.56
60	52.51	20.67
65	52.80	20.79
70	53.11	20.91
75	53.45	21.04
80	53.83	21.19
85	54.26	21.36
90	54.80	21.58
95	55.59	21.88
97	56.07	22.07
98	56.40	22.21
99	56.89	22.40

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# POPLITEAL HEIGHT, SITTING

Subject sits erect with feet resting on a surface adjusted so that the knees are bent at approximately right angles. Using the anthropometer, measure the vertical distance from the footrest surface to the underside of the left knee.

N 422

MEAN	43.47 $\pm$ 0.10 CM.	17.12 $\pm$ 0.04 IN.
S.D.	2.11 $\pm$ 0.07 CM.	0.83 $\pm$ 0.03 IN.
MINIMUM	29.00 CM.	11.42 IN.
MAXIMUM	49.90 CM.	19.65 IN.
C.V.	4.85 %	4.85 %

	CM.	IN.
	1	39.15
	2	39.65
	3	39.96
	5	40.36
	10	40.99
	15	41.42
P	20	41.77
E	25	42.08
R	30	42.37
C	35	42.64
E	40	42.90
N	45	43.16
T	50	43.42
I	55	43.69
L	60	43.96
E	65	44.25
S	70	44.56
	75	44.89
	80	45.27
	85	45.71
	90	46.25
	95	47.02
	97	47.48
	98	47.79
	99	48.22



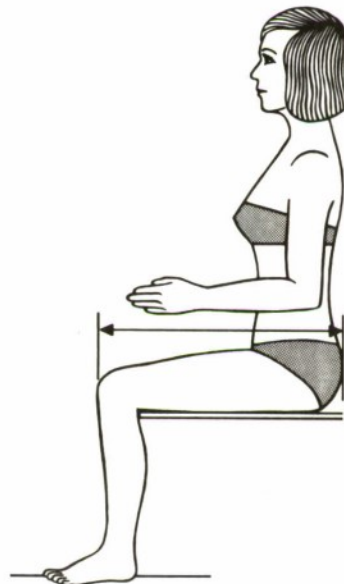
# BUTTOCK-KNEE LENGTH

Subject sits erect with feet resting on a surface adjusted so that the knees are bent at about right angles. Using the anthropometer, measure the horizontal distance from the rearmost surface of the left buttock to the front of the kneecap.

N 423

MEAN	57.46 $\pm$ 0.11 CM.	22.62 $\pm$ 0.04 IN.
S.D.	2.35 $\pm$ 0.08 CM.	0.92 $\pm$ 0.03 IN.
MINIMUM	48.20 CM.	18.98 IN.
MAXIMUM	66.10 CM.	26.02 IN.
C.V.	4.09 %	4.09 %

		CM.	IN.
	1	52.21	20.56
	2	52.84	20.80
	3	53.23	20.96
	5	53.76	21.17
	10	54.57	21.48
	15	55.11	21.70
P	20	55.54	21.87
E	25	55.91	22.01
R	30	56.25	22.14
C	35	56.56	22.27
E	40	56.86	22.38
N	45	57.15	22.50
T	50	57.44	22.61
I	55	57.73	22.73
L	60	58.03	22.84
E	65	58.34	22.97
S	70	58.67	23.10
	75	59.03	23.24
	80	59.45	23.40
	85	59.93	23.60
	90	60.56	23.84
	95	61.53	24.22
	97	62.18	24.48
	98	62.66	24.67
	99	63.45	24.98





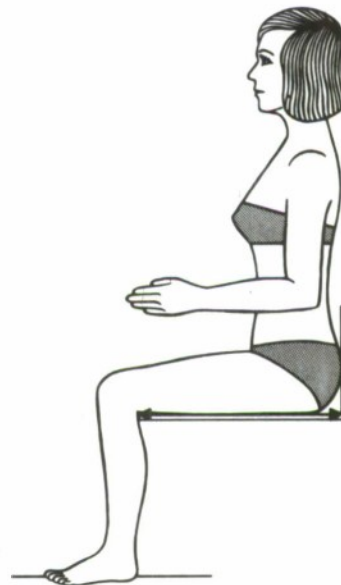
## BUTTOCK-POPLITEAL LENGTH

Subject sits erect with feet resting on a surface adjusted so that the knees are bent at about right angles and the calves are in contact with the edge of the table. With a sheet of plexiglass touching the rearmost surface of the buttocks and using the scale on the table surface, measure the horizontal distance from the most posterior protrusion of the left buttock to the back of the knee.

N 423

MEAN	48.17 $\pm$ 0.12 CM.	18.97 $\pm$ 0.05 IN.
S.D.	2.48 $\pm$ 0.09 CM.	0.98 $\pm$ 0.03 IN.
MINIMUM	39.20 CM.	15.43 IN.
MAXIMUM	56.70 CM.	22.32 IN.
C.V.	5.16 %	5.16 %

	CM.	IN.
	1 42.72	16.82
	2 43.32	17.06
	3 43.72	17.21
	5 44.27	17.43
	10 45.14	17.77
	15 45.72	18.00
P	20 46.18	18.18
E	25 46.58	18.34
R	30 46.93	18.48
C	35 47.25	18.60
E	40 47.56	18.72
N	45 47.86	18.84
T	50 48.15	18.96
I	55 48.44	19.07
L	60 48.74	19.19
E	65 49.05	19.31
S	70 49.38	19.44
	75 49.75	19.59
	80 50.17	19.75
	85 50.67	19.95
	90 51.34	20.21
	95 52.44	20.64
	97 53.24	20.96
	98 53.88	21.21
	99 54.99	21.65



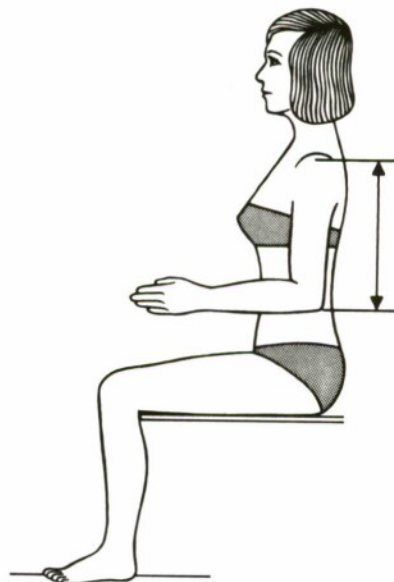
# SHOULDER-ELBOW LENGTH

Subject sits erect with feet resting lightly on footrest, left upper arm hanging at her side and lower arm extended forward horizontally. Using the anthropometer, measure the vertical distance from the left acromiale to the bottom of the elbow.

N 423

MEAN	33.70 $\pm$ 0.07 CM.	13.27 $\pm$ 0.03 IN.
S.D.	1.46 $\pm$ 0.05 CM.	0.57 $\pm$ 0.02 IN.
MINIMUM	29.80 CM.	11.73 IN.
MAXIMUM	39.40 CM.	15.51 IN.
C.V.	4.33 %	4.33 %

	CM.	IN.
	1 30.57	12.03
	2 30.93	12.18
	3 31.16	12.27
	5 31.47	12.39
	10 31.94	12.57
	15 32.26	12.70
P	20 32.52	12.80
E	25 32.74	12.89
R	30 32.95	12.97
C	35 33.14	13.05
E	40 33.32	13.12
N	45 33.50	13.19
T	50 33.69	13.26
I	55 33.87	13.33
L	60 34.06	13.41
E	65 34.26	13.49
S	70 34.47	13.57
	75 34.70	13.66
	80 34.96	13.76
	85 35.27	13.88
	90 35.66	14.04
	95 36.23	14.26
	97 36.60	14.41
	98 36.87	14.51
	99 37.27	14.67



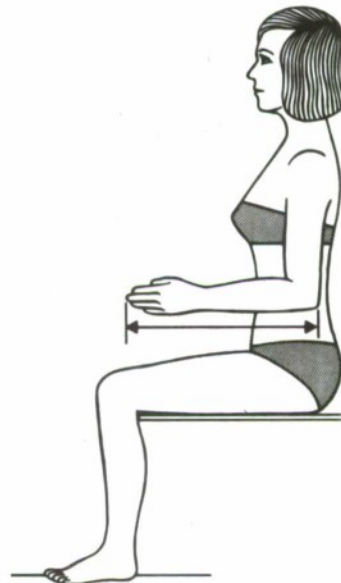
# ELBOW-HAND LENGTH

Subject sits erect with feet resting lightly on footrest, upper arms hanging to her side and lower arms and hands extended forward horizontally. Using the anthropometer, measure the distance from the back of the left elbow to the tip of the middle finger.

N 423

MEAN	43.52 $\pm$ 0.08 CM.	17.13 $\pm$ 0.03 IN.
S.D.	1.71 $\pm$ 0.06 CM.	0.67 $\pm$ 0.02 IN.
MINIMUM	39.20 CM.	15.43 IN.
MAXIMUM	49.10 CM.	19.33 IN.
C.V.	3.94 %	3.94 %

		CM.	IN.
P E R C E N T I L E S	1	39.94	15.73
	2	40.20	15.83
	3	40.41	15.91
	5	40.74	16.04
	10	41.32	16.27
	15	41.74	16.43
	20	42.08	16.57
	25	42.38	16.69
	30	42.65	16.79
	35	42.90	16.89
	40	43.13	16.98
	45	43.35	17.07
	50	43.57	17.15
	55	43.79	17.24
	60	44.01	17.33
	65	44.23	17.41
	70	44.46	17.50
	75	44.71	17.60
	80	44.99	17.71
	85	45.31	17.84
	90	45.74	18.01
	95	46.40	18.27
	97	46.88	18.46
	98	47.26	18.61
	99	47.93	18.87



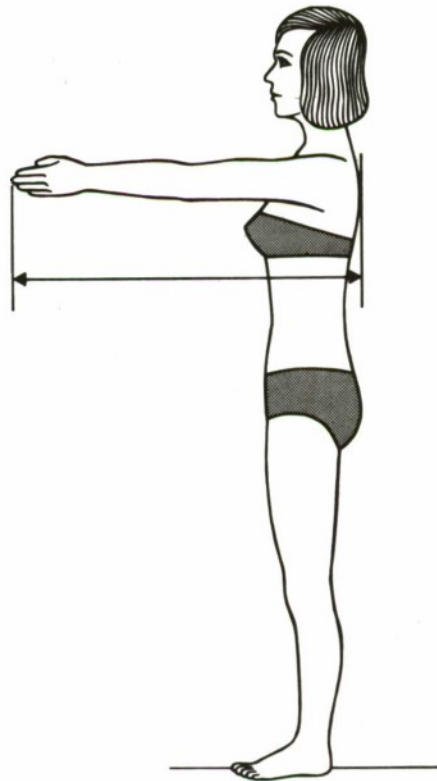
## ARM REACH, HORIZONTAL

Subject stands erect with shoulders firmly against the wall and extends her left arm horizontally with fingers extended. Using the anthropometer, measure the distance between the tip of the middle finger and the wall.

N 422

MEAN	78.81 $\pm$ 0.16 CM.	31.03 $\pm$ 0.06 IN.
S.D.	3.26 $\pm$ 0.11 CM.	1.28 $\pm$ 0.04 IN.
MINIMUM	70.00 CM.	27.56 IN.
MAXIMUM	88.30 CM.	34.76 IN.
C.V.	4.14 %	4.14 %

		CM.	IN.
P E R C E N T I L E S	1	72.03	28.36
	2	72.73	28.63
	3	73.18	28.81
	5	73.79	29.05
	10	74.76	29.43
	15	75.44	29.70
	20	76.00	29.92
	25	76.50	30.12
	30	76.96	30.30
	35	77.39	30.47
	40	77.81	30.63
	45	78.23	30.80
	50	78.65	30.96
	55	79.07	31.13
	60	79.51	31.30
	65	79.97	31.49
	70	80.47	31.68
	75	81.01	31.89
	80	81.63	32.14
	85	82.34	32.42
	90	83.26	32.78
	95	84.61	33.31
	97	85.46	33.65
	98	86.07	33.89
	99	86.99	34.25



## MAXIMUM OVERHEAD ARM REACH, SITTING

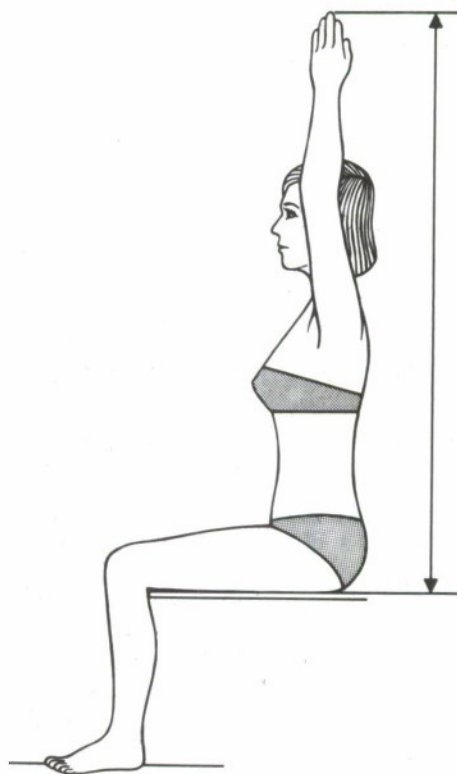
Subject sits erect with left arm extended vertically. With the anthropometer, measure the distance from the seat level to the tip of the extended middle finger.

N 423

MEAN	132.91 $\pm$ 0.23 CM.	52.33 $\pm$ 0.09 IN.
S.D.	4.74 $\pm$ 0.16 CM.	1.87 $\pm$ 0.06 IN.
MINIMUM	118.70 CM.	46.73 IN.
MAXIMUM	148.10 CM.	58.31 IN.
C.V.	3.57 %	3.57 %

	CM.	IN.
1	121.83	47.96
2	122.76	48.33
3	123.50	48.62
5	124.62	49.06
10	126.54	49.82
15	127.88	50.35
20	128.95	50.77
25	129.86	51.13
30	130.65	51.44
35	131.37	51.72
40	132.03	51.98
45	132.66	52.23
50	133.25	52.46
55	133.83	52.69
60	134.40	52.91
65	134.97	53.14
70	135.55	53.37
75	136.16	53.61
80	136.83	53.87
85	137.60	54.17
90	138.57	54.56
95	140.12	55.17
97	141.26	55.62
98	142.21	55.99
99	143.92	56.66

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## NECK CIRCUMFERENCE

Subject stands erect. Holding the tape perpendicular to the axis of the neck at the level immediately below the thyroid cartilage, measure the circumference of the neck.

N 421

MEAN	29.87 $\pm$ 0.06 CM.	11.76 $\pm$ 0.02 IN.
S.D.	1.16 $\pm$ 0.04 CM.	0.46 $\pm$ 0.02 IN.
MINIMUM	27.30 CM.	10.75 IN.
MAXIMUM	33.30 CM.	13.11 IN.
C.V.	3.88 %	3.88 %

		CM.	IN.
P E R C E N T I L E S	1	27.58	10.86
	2	27.79	10.94
	3	27.92	10.99
	5	28.12	11.07
	10	28.45	11.20
	15	28.69	11.30
	20	28.89	11.37
	25	29.07	11.44
	30	29.24	11.51
	35	29.40	11.57
	40	29.55	11.63
	45	29.70	11.69
	50	29.85	11.75
	55	30.01	11.81
	60	30.17	11.88
	65	30.34	11.94
	70	30.52	12.01
	75	30.71	12.09
	80	30.93	12.18
	85	31.18	12.28
	90	31.51	12.40
	95	31.97	12.59
	97	32.26	12.70
	98	32.46	12.78
	99	32.77	12.90



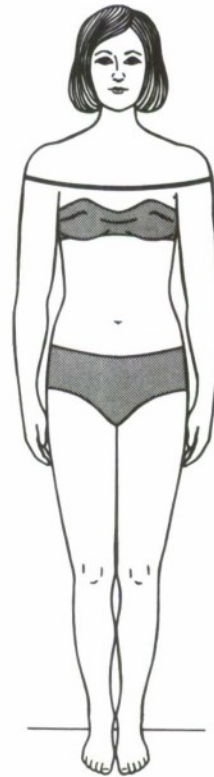
## SHOULDER CIRCUMFERENCE

Subject stands erect with arms hanging relaxed at her sides. Holding the tape in a horizontal plane, measure the maximum circumference of the shoulders at the level of greatest lateral protrusion of the deltoid muscles.

N 422

MEAN	95.53 $\pm$ 0.16 CM.	37.61 $\pm$ 0.06 IN.
S.D.	3.23 $\pm$ 0.11 CM.	1.27 $\pm$ 0.04 IN.
MINIMUM	85.50 CM.	33.66 IN.
MAXIMUM	110.50 CM.	43.50 IN.
C.V.	3.38 %	3.38 %

	CM.	IN.
	1 87.78	34.56
	2 88.89	34.99
	3 89.55	35.25
	5 90.40	35.59
	10 91.65	36.08
	15 92.44	36.40
P	20 93.06	36.64
E	25 93.58	36.84
R	30 94.04	37.02
C	35 94.46	37.19
E	40 94.87	37.35
N	45 95.25	37.50
T	50 95.63	37.65
I	55 96.02	37.80
L	60 96.41	37.96
E	65 96.81	38.12
S	70 97.24	38.29
	75 97.72	38.47
	80 98.25	38.68
	85 98.88	38.93
	90 99.69	39.25
	95 100.93	39.74
	97 101.76	40.06
	98 102.38	40.31
	99 103.39	40.70



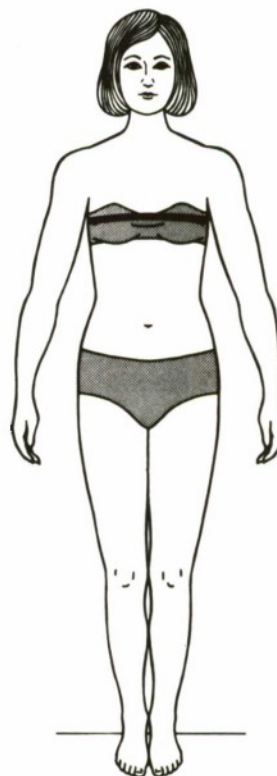
## BUST CIRCUMFERENCE

Subject stands erect with arms slightly raised. Holding the tape in a horizontal plane at the level of the nipples, measure the maximum circumference during normal breathing.

N 221

MEAN	85.64 $\pm$ 0.27 CM.	33.71 $\pm$ 0.11 IN.
S.D.	3.97 $\pm$ 0.19 CM.	1.56 $\pm$ 0.07 IN.
MINIMUM	75.60 CM.	29.76 IN.
MAXIMUM	95.20 CM.	37.48 IN.
C.V.	4.64 %	4.64 %

	CM.	IN.
1	76.10	29.96
2	77.50	30.51
3	78.30	30.83
5	79.31	31.22
10	80.73	31.79
15	81.65	32.15
P	20	82.36
E	25	82.98
R	30	83.53
C	35	84.05
E	40	84.55
N	45	85.04
T	50	85.54
I	55	86.04
L	60	86.56
E	65	87.10
S	70	87.68
	75	88.32
	80	89.05
	85	89.89
	90	90.96
	95	92.50
	97	93.44
	98	94.08
	99	94.98



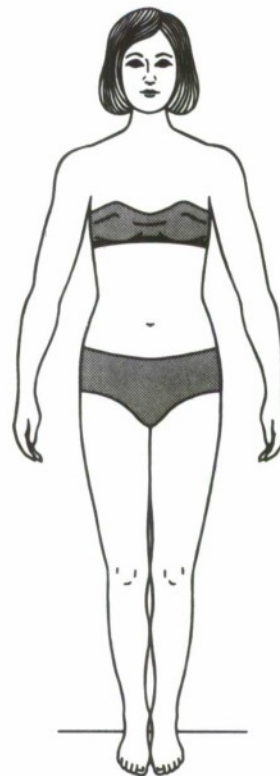
# CHEST CIRCUMFERENCE--INSPIRATION

Subject stands erect with arms slightly raised. Holding the tape in a horizontal position immediately below the breasts, measure the circumference of the chest at maximum inhalation.

N 406

MEAN	74.63 $\pm$ 0.16 CM.	29.38 $\pm$ 0.06 IN.
S.D.	3.24 $\pm$ 0.11 CM.	1.28 $\pm$ 0.04 IN.
MINIMUM	65.30 CM.	25.71 IN.
MAXIMUM	84.00 CM.	33.07 IN.
C.V.	4.34 %	4.34 %

		CM.	IN.
P E R C E N T I L E S	1	67.23	26.47
	2	68.01	26.78
	3	68.53	26.98
	5	69.27	27.27
	10	70.45	27.74
	15	71.27	28.06
	20	71.92	28.31
	25	72.48	28.54
	30	72.98	28.73
	35	73.45	28.92
	40	73.88	29.09
	45	74.30	29.25
	50	74.72	29.42
	55	75.13	29.58
	60	75.54	29.74
	65	75.97	29.91
	70	76.41	30.08
	75	76.89	30.27
	80	77.43	30.48
	85	78.04	30.73
	90	78.82	31.03
	95	79.98	31.49
	97	80.74	31.79
	98	81.31	32.01
	99	82.24	32.38



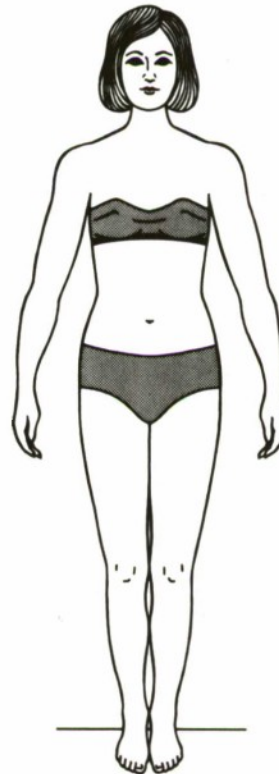
# CHEST CIRCUMFERENCE--EXPIRATION

Subject stands erect with arms slightly raised. Holding the tape in a horizontal position immediately below the breasts, measure the circumference of the chest at maximum exhalation.

N 406

MEAN	67.69 $\pm$ 0.15 CM.	26.65 $\pm$ 0.06 IN.
S.D.	2.94 $\pm$ 0.10 CM.	1.16 $\pm$ 0.04 IN.
MINIMUM	60.00 CM.	23.62 IN.
MAXIMUM	75.50 CM.	29.72 IN.
C.V.	4.34 %	4.34 %

	CM.	IN.
	1 61.11	24.06
	2 61.94	24.39
	3 62.44	24.58
	5 63.11	24.85
	10 64.12	25.24
	15 64.80	25.51
P	20 65.33	25.72
E	25 65.80	25.90
R	30 66.21	26.07
C	35 66.61	26.22
E	40 66.98	26.37
N	45 67.35	26.51
T	50 67.71	26.66
I	55 68.08	26.80
L	60 68.46	26.95
E	65 68.86	27.11
S	70 69.29	27.28
	75 69.75	27.46
	80 70.28	27.67
	85 70.90	27.91
	90 71.69	28.22
	95 72.88	28.69
	97 73.65	29.00
	98 74.22	29.22
	99 75.11	29.57





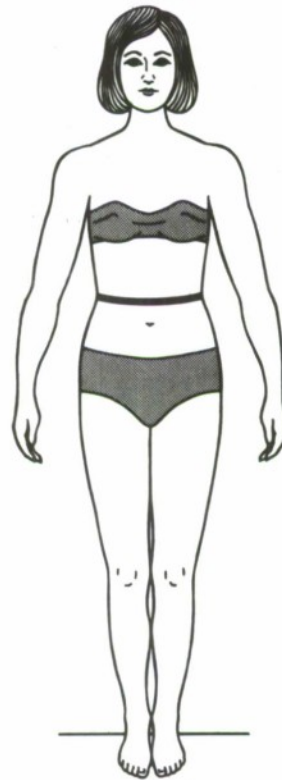
# WAIST CIRCUMFERENCE

Subject stands erect with arms slightly raised. Holding the tape in a horizontal plane, measure the minimum circumference between the superior margins of the iliac crest and the inferior lateral margins of the thorax. The subject is instructed not to contract abdominal musculature.

N 394

MEAN	62.22 $\pm$ 0.14 CM.	24.50 $\pm$ 0.06 IN.
S.D.	2.80 $\pm$ 0.10 CM.	1.10 $\pm$ 0.04 IN.
MINIMUM	55.50 CM.	21.85 IN.
MAXIMUM	71.00 CM.	27.95 IN.
C.V.	4.50 %	4.50 %

	CM.	IN.
	1 56.33	22.18
	2 56.91	22.40
	3 57.30	22.56
	5 57.86	22.78
	10 58.77	23.14
	15 59.41	23.39
P	20 59.92	23.59
E	25 60.38	23.77
R	30 60.79	23.93
C	35 61.17	24.08
E	40 61.53	24.23
N	45 61.89	24.37
T	50 62.24	24.51
I	55 62.60	24.65
L	60 62.96	24.79
E	65 63.34	24.94
S	70 63.74	25.09
	75 64.17	25.27
	80 64.67	25.46
	85 65.24	25.69
	90 65.99	25.98
	95 67.13	26.43
	97 67.90	26.73
	98 68.49	26.96
	99 69.45	27.34



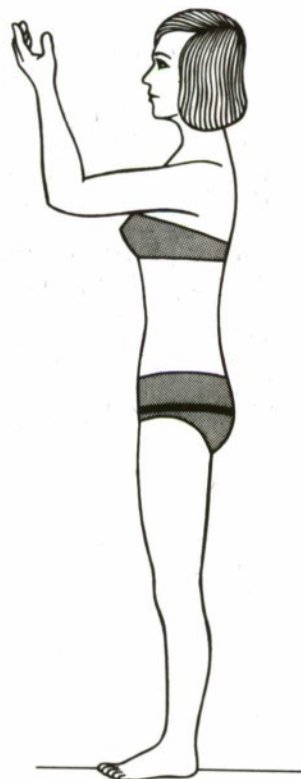
## HIP CIRCUMFERENCE

Subject stands erect. Holding the tape in a horizontal plane, measure the circumference of the hip at the level of maximum posterior protrusion of the buttocks.

N 422

MEAN	90.06 $\pm$ 0.16 CM.	35.46 $\pm$ 0.06 IN.
S.D.	3.34 $\pm$ 0.11 CM.	1.31 $\pm$ 0.05 IN.
MINIMUM	81.20 CM.	31.97 IN.
MAXIMUM	99.80 CM.	39.29 IN.
C.V.	3.71 %	3.71 %

	CM.	IN.	
1	82.37	32.43	
2	83.33	32.81	
3	83.92	33.04	
5	84.71	33.35	
10	85.88	33.81	
15	86.66	34.12	
P	20	87.28	34.36
E	25	87.80	34.57
R	30	88.27	34.75
C	35	88.71	34.93
E	40	89.13	35.09
N	45	89.53	35.25
T	50	89.94	35.41
I	55	90.35	35.57
L	60	90.77	35.73
E	65	91.21	35.91
S	70	91.68	36.09
	75	92.20	36.30
	80	92.79	36.53
	85	93.51	36.81
	90	94.44	37.18
	95	95.92	37.76
	97	96.94	38.17
	98	97.73	38.48
	99	99.04	38.99



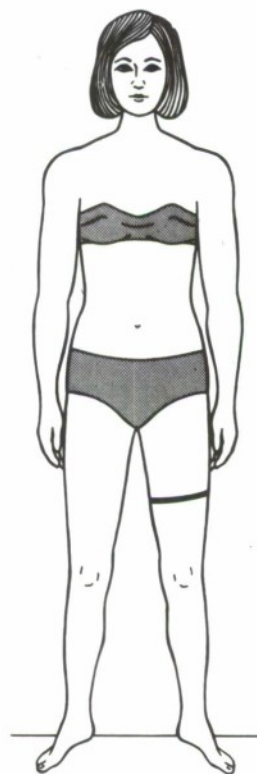
## THIGH CIRCUMFERENCE

Subject stands erect with feet slightly apart and weight evenly distributed. Holding the tape in a horizontal plane, measure the circumference of the thigh at a point midway between the crotch and the superior border of the patella.

N 422

MEAN	46.21 $\pm$ 0.11 CM.	18.19 $\pm$ 0.04 IN.
S.D.	2.24 $\pm$ 0.08 CM.	0.88 $\pm$ 0.03 IN.
MINIMUM	39.70 CM.	15.63 IN.
MAXIMUM	51.70 CM.	20.35 IN.
C.V.	4.84 %	4.84 %

	CM.	IN.
	1 40.47	15.93
	2 41.38	16.29
	3 41.90	16.50
	5 42.54	16.75
	10 43.43	17.10
	15 43.98	17.32
P	20 44.40	17.48
E	25 44.77	17.62
R	30 45.09	17.75
C	35 45.38	17.87
E	40 45.67	17.98
N	45 45.94	18.09
T	50 46.22	18.20
I	55 46.50	18.31
L	60 46.79	18.42
E	65 47.09	18.54
S	70 47.41	18.66
	75 47.75	18.80
	80 48.15	18.95
	85 48.60	19.13
	90 49.17	19.36
	95 49.97	19.67
	97 50.45	19.86
	98 50.76	19.99
	99 51.19	20.15



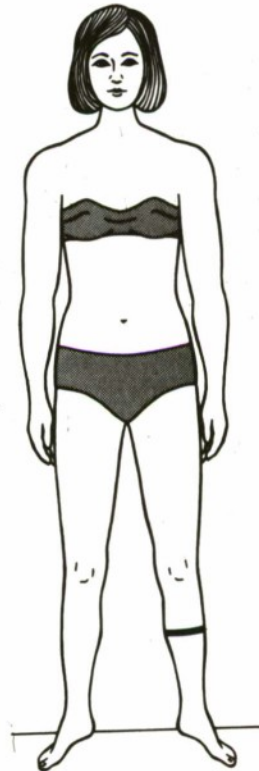
## CALF CIRCUMFERENCE

Subjects stands with heels about 10 cm apart and weight equally distributed on both feet. Holding the tape in a horizontal plane, measure the maximum circumference of the left calf.

N 422

MEAN	32.21 $\pm$ 0.08 CM.	12.68 $\pm$ 0.03 IN.
S.D.	1.63 $\pm$ 0.06 CM.	0.64 $\pm$ 0.02 IN.
MINIMUM	27.30 CM.	10.75 IN.
MAXIMUM	37.00 CM.	14.57 IN.
C.V.	5.06 %	5.06 %

	CM.	IN.
1	28.38	11.17
2	28.84	11.35
3	29.13	11.47
5	29.53	11.62
10	30.14	11.87
15	30.55	12.03
P	20	30.87
E	25	31.15
R	30	31.40
C	35	31.63
E	40	31.85
N	45	32.06
T	50	32.27
I	55	32.48
L	60	32.69
E	65	32.90
S	70	33.13
	75	33.37
	80	33.64
	85	33.95
	90	34.34
	95	34.90
	97	35.25
	98	35.51
	99	35.90



# ANKLE CIRCUMFERENCE

Subject stands with heels about 10 cm apart and weight equally distributed on both feet. Holding the tape in a horizontal plane, measure the minimum circumference of the left ankle.

N 422

MEAN	20.14 $\pm$ 0.05 CM.	7.93 $\pm$ 0.02 IN.
S.D.	1.03 $\pm$ 0.04 CM.	0.40 $\pm$ 0.01 IN.
MINIMUM	17.20 CM.	6.77 IN.
MAXIMUM	22.80 CM.	8.98 IN.
C. V.	5.11 %	5.11 %

	CM.	IN.
	1 17.72	6.98
	2 18.05	7.11
	3 18.24	7.18
	5 18.49	7.28
	10 18.84	7.42
	15 19.07	7.51
P	20 19.25	7.58
E	25 19.41	7.64
R	30 19.56	7.70
C	35 19.70	7.76
E	40 19.84	7.81
N	45 19.97	7.86
T	50 20.11	7.92
I	55 20.25	7.97
L	60 20.39	8.03
E	65 20.54	8.09
S	70 20.70	8.15
	75 20.87	8.22
	80 21.06	8.29
	85 21.28	8.38
	90 21.55	8.48
	95 21.91	8.63
	97 22.11	8.70
	98 22.23	8.75
	99 22.35	8.80





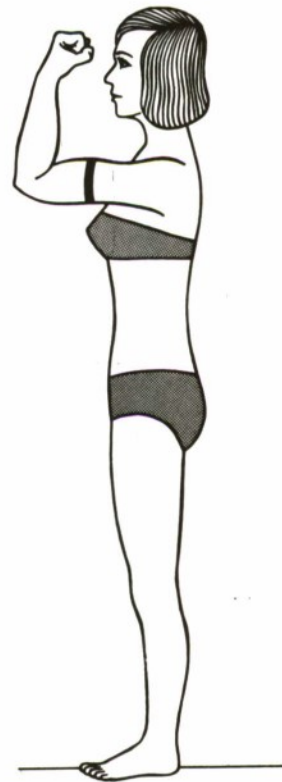
# UPPER ARM CIRCUMFERENCE -- FLEXED

Subject stands erect with left arm raised and maximally flexed. Holding the tape in a plane perpendicular to the axis of the upper arm, measure the maximum circumference of the left bicep.

N 422

MEAN	24.57 $\pm$ 0.07 CM.	9.67 $\pm$ 0.03 IN.
S.D.	1.35 $\pm$ 0.05 CM.	0.53 $\pm$ 0.02 IN.
MINIMUM	20.70 CM.	8.15 IN.
MAXIMUM	28.20 CM.	11.10 IN.
C.V.	5.51 %	5.51 %

		CM.	IN.
P E R C E N T I L E S	1	21.49	8.46
	2	21.77	8.57
	3	21.98	8.65
	5	22.28	8.77
	10	22.77	8.96
	15	23.11	9.10
	20	23.39	9.21
	25	23.63	9.30
	30	23.85	9.39
	35	24.05	9.47
	40	24.23	9.54
	45	24.41	9.61
	50	24.59	9.68
	55	24.76	9.75
	60	24.94	9.82
	65	25.11	9.89
	70	25.30	9.96
	75	25.49	10.04
	80	25.71	10.12
	85	25.96	10.22
	90	26.27	10.34
	95	26.73	10.52
	97	27.03	10.64
	98	27.26	10.73
	99	27.63	10.88



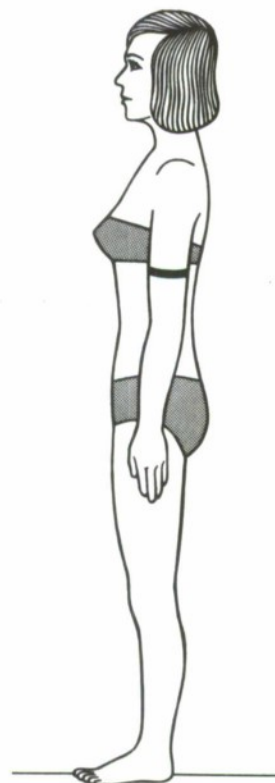
# UPPER ARM CIRCUMFERENCE--EXTENDED

Subject stands erect with arms hanging extended at her sides. Holding the tape at the same level as the previous measurement, measure circumference of the relaxed bicep.

N 422

MEAN	23.32 $\pm$ 0.07 CM.	9.18 $\pm$ 0.03 IN.
S.D.	1.35 $\pm$ 0.05 CM.	0.53 $\pm$ 0.02 IN.
MINIMUM	19.50 CM.	7.68 IN.
MAXIMUM	27.00 CM.	10.63 IN.
C.V.	5.80 %	5.80 %

		CM.	IN.
P E R C E N T I L E S	1	20.18	7.94
	2	20.54	8.09
	3	20.76	8.17
	5	21.07	8.30
	10	21.56	8.49
	15	21.89	8.62
	20	22.15	8.72
	25	22.38	8.81
	30	22.58	8.89
	35	22.77	8.97
	40	22.96	9.04
	45	23.13	9.11
	50	23.31	9.18
	55	23.48	9.25
	60	23.66	9.32
	65	23.84	9.39
	70	24.04	9.46
	75	24.24	9.54
	80	24.47	9.64
	85	24.74	9.74
	90	25.06	9.87
	95	25.52	10.05
	97	25.80	10.16
	98	26.00	10.24
	99	26.28	10.35



## FOREARM CIRCUMFERENCE

Subject stands erect with arms extended. Holding the tape perpendicular to the long axis of the arm, measure the maximum circumference of the forearm.

N 422

MEAN	20.69 $\pm$ 0.05 CM.	8.14 $\pm$ 0.02 IN.
S.D.	1.06 $\pm$ 0.04 CM.	0.42 $\pm$ 0.01 IN.
MINIMUM	17.50 CM.	6.89 IN.
MAXIMUM	24.00 CM.	9.45 IN.
C.V.	5.11 %	5.11 %

	CM.	IN.
	1 18.23	7.18
	2 18.52	7.29
	3 18.71	7.37
	5 18.96	7.46
	10 19.34	7.61
	15 19.59	7.71
P	20 19.79	7.79
E	25 19.96	7.86
R	30 20.11	7.92
C	35 20.25	7.97
E	40 20.39	8.03
N	45 20.51	8.08
T	50 20.64	8.13
I	55 20.77	8.18
L	60 20.90	8.23
E	65 21.03	8.28
S	70 21.17	8.34
	75 21.33	8.40
	80 21.51	8.47
	85 21.72	8.55
	90 22.00	8.66
	95 22.44	8.84
	97 22.75	8.96
	98 22.99	9.05
	99 23.39	9.21



# WRIST CIRCUMFERENCE

Subject stands with hand extended. Holding the tape perpendicular to the long axis of the arm, measure the circumference of the wrist immediately proximal to the ulnar styloid process.

N 422

MEAN	13.68 $\pm$ 0.03 CM.	5.39 $\pm$ 0.01 IN.
S.D.	0.69 $\pm$ 0.02 CM.	0.27 $\pm$ 0.01 IN.
MINIMUM	11.80 CM.	4.65 IN.
MAXIMUM	16.00 CM.	6.30 IN.
C.V.	5.06 %	5.06 %

	CM.	IN.
	1 12.24	4.82
	2 12.40	4.88
	3 12.51	4.92
	5 12.65	4.98
	10 12.86	5.06
	15 13.01	5.12
P	20 13.13	5.17
E	25 13.24	5.21
R	30 13.34	5.25
C	35 13.43	5.29
E	40 13.52	5.32
N	45 13.61	5.36
T	50 13.70	5.39
I	55 13.79	5.43
L	60 13.88	5.46
E	65 13.98	5.50
S	70 14.08	5.54
	75 14.20	5.59
	80 14.32	5.64
	85 14.47	5.70
	90 14.66	5.77
	95 14.93	5.88
	97 15.09	5.94
	98 15.20	5.98
	99 15.36	6.05



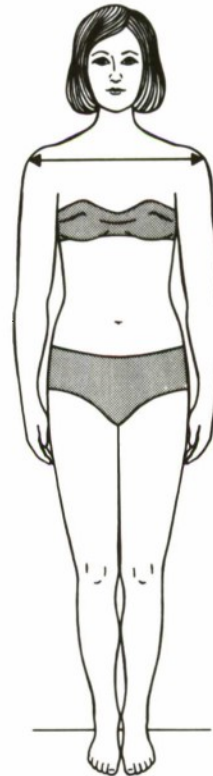
## BIACROMIAL BREADTH

Subject stands erect with arms hanging at her sides. Using the anthropometer, measure the distance between the acromial points.

N 422

MEAN	35.03 $\pm$ 0.07 CM.	13.79 $\pm$ 0.03 IN.
S.D.	1.48 $\pm$ 0.05 CM.	0.58 $\pm$ 0.02 IN.
MINIMUM	30.10 CM.	11.85 IN.
MAXIMUM	39.50 CM.	15.55 IN.
C.V.	4.23 %	4.23 %

		CM.	IN.
P E R C E N T I L E S	1	31.56	12.42
	2	32.05	12.62
	3	32.34	12.73
	5	32.71	12.88
	10	33.24	13.09
	15	33.58	13.22
	20	33.84	13.32
	25	34.07	13.41
	30	34.28	13.50
	35	34.47	13.57
	40	34.66	13.64
	45	34.84	13.72
	50	35.02	13.79
	55	35.20	13.86
	60	35.39	13.93
	65	35.59	14.01
	70	35.80	14.10
	75	36.04	14.19
	80	36.30	14.29
	85	36.61	14.42
	90	37.01	14.57
	95	37.59	14.80
	97	37.96	14.95
	98	38.22	15.05
	99	38.61	15.20





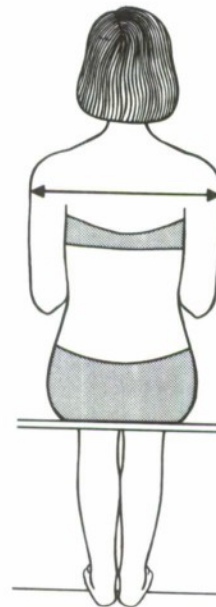
## BIDELTOID BREADTH

Subject sits erect with feet resting lightly on footrest, upper arms hanging at her sides, and lower arms extended forward horizontally. Using the anthropometer, measure the horizontal distance across the maximum lateral protrusions at the deltoid muscles.

N 421

MEAN	40.56 $\pm$ 0.08 CM.	15.97 $\pm$ 0.03 IN.
S.D.	1.57 $\pm$ 0.05 CM.	0.62 $\pm$ 0.02 IN.
MINIMUM	35.40 CM.	13.94 IN.
MAXIMUM	44.40 CM.	17.48 IN.
C.V.	3.87 %	3.87 %

	CM.	IN.	
1	36.25	14.27	
2	36.95	14.55	
3	37.36	14.71	
5	37.87	14.91	
10	38.59	15.19	
15	39.03	15.37	
P	20	39.36	15.50
E	25	39.64	15.60
R	30	39.88	15.70
C	35	40.09	15.78
E	40	40.29	15.86
N	45	40.49	15.94
T	50	40.68	16.01
I	55	40.86	16.09
L	60	41.05	16.16
E	65	41.24	16.24
S	70	41.45	16.32
	75	41.67	16.41
	80	41.92	16.50
	85	42.21	16.62
	90	42.57	16.76
	95	43.12	16.98
	97	43.48	17.12
	98	43.74	17.22
	99	44.15	17.38



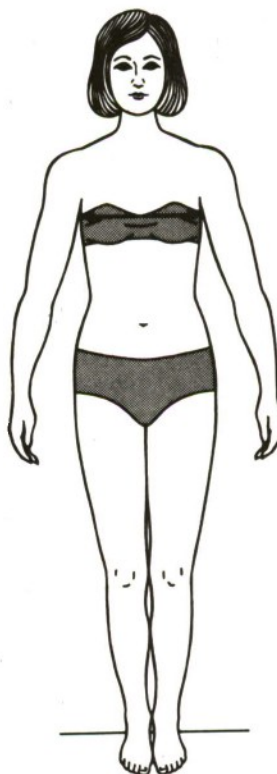
## CHEST BREADTH

Subject stands erect with arms initially raised and then lowered when the instrument is in place. Using the anthropometer, measure the horizontal breadth of the chest at the level of the inferior margin of the xiphoid process of the sternum.

N 422

MEAN	24.06 $\pm$ 0.07 CM.	9.47 $\pm$ 0.03 IN.
S.D.	1.39 $\pm$ 0.05 CM.	0.55 $\pm$ 0.02 IN.
MINIMUM	20.40 CM.	8.03 IN.
MAXIMUM	27.70 CM.	10.91 IN.
C.V.	5.77 %	5.77 %

		CM.	IN.
P E R C E N T I L E S	1	21.24	8.36
	2	21.36	8.41
	3	21.49	8.46
	5	21.73	8.55
	10	22.18	8.73
	15	22.52	8.87
	20	22.81	8.98
	25	23.07	9.08
	30	23.29	9.17
	35	23.51	9.25
	40	23.71	9.33
	45	23.90	9.41
	50	24.09	9.48
	55	24.27	9.56
	60	24.45	9.63
	65	24.64	9.70
	70	24.84	9.78
	75	25.04	9.86
	80	25.27	9.95
	85	25.52	10.05
	90	25.85	10.18
	95	26.33	10.37
	97	26.66	10.50
	98	26.92	10.60
	99	27.37	10.78



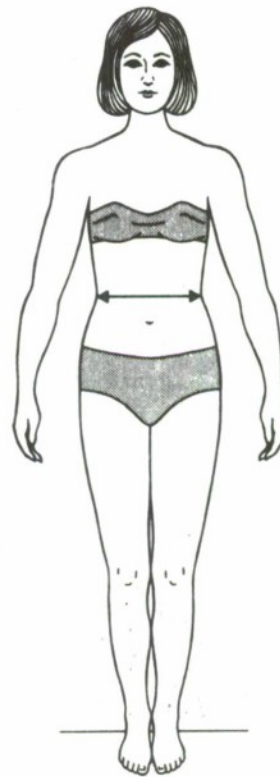
# WAIST BREADTH

Subject stands erect. Holding the anthropometer horizontally, measure the transverse breadth at the narrowest part of the waist.

N 394

MEAN	22.26 $\pm$ 0.06 CM.	8.76 $\pm$ 0.02 IN.
S.D.	1.11 $\pm$ 0.04 CM.	0.44 $\pm$ 0.02 IN.
MINIMUM	19.60 CM.	7.72 IN.
MAXIMUM	25.80 CM.	10.16 IN.
C.V.	5.01 %	5.01 %

		CM.	IN.
P E R C E N T I L E S	1	20.01	7.88
	2	20.18	7.95
	3	20.32	8.00
	5	20.52	8.08
	10	20.87	8.22
	15	21.13	8.32
	20	21.33	8.40
	25	21.51	8.47
	30	21.68	8.53
	35	21.83	8.59
	40	21.97	8.65
	45	22.11	8.71
	50	22.25	8.76
	55	22.39	8.81
	60	22.53	8.87
	65	22.67	8.93
	70	22.83	8.99
	75	22.99	9.05
	80	23.18	9.13
	85	23.41	9.22
	90	23.71	9.33
	95	24.19	9.52
	97	24.53	9.66
	98	24.81	9.77
	99	25.29	9.96



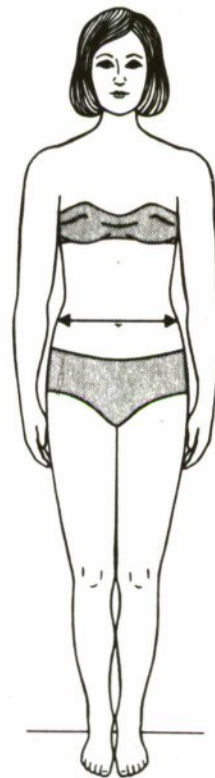
# ILIOCRISTALE BREADTH

Subject stands erect with weight evenly distributed on both feet.  
Using the anthropometer with firm pressure, measure the maximum transverse diameter between the superio-lateral margins of the iliac crests.

N 406

MEAN	27.27 $\pm$ 0.07 CM.	10.74 $\pm$ 0.03 IN.
S.D.	1.41 $\pm$ 0.05 CM.	0.55 $\pm$ 0.02 IN.
MINIMUM	23.70 CM.	9.33 IN.
MAXIMUM	31.60 CM.	12.44 IN.
C.V.	5.16 %	5.16 %

		CM.	IN.
P E R C E N T I L E S	1	24.19	9.53
	2	24.48	9.64
	3	24.68	9.72
	5	24.97	9.83
	10	25.44	10.02
	15	25.78	10.15
	20	26.04	10.25
	25	26.28	10.35
	30	26.49	10.43
	35	26.69	10.51
	40	26.88	10.58
	45	27.06	10.65
	50	27.24	10.72
	55	27.42	10.79
	60	27.60	10.87
	65	27.79	10.94
	70	27.99	11.02
	75	28.20	11.10
	80	28.44	11.20
	85	28.73	11.31
	90	29.09	11.45
	95	29.65	11.67
	97	30.03	11.82
	98	30.32	11.94
	99	30.80	12.13



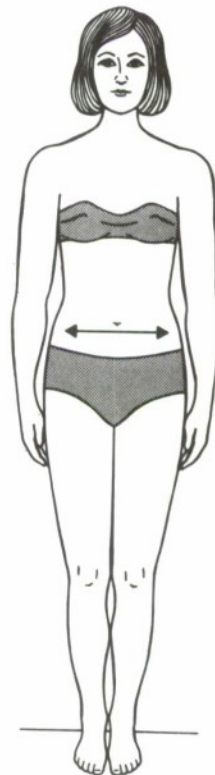
# ILIOSPINALE BREADTH

Subject stands erect with weight evenly distributed on both feet.  
Using the anthropometer, measure the transverse distance between  
the centers of the anterior superior iliac spines.

N 406

MEAN	22.11 $\pm$ 0.08 CM.	8.70 $\pm$ 0.03 IN.
S.D.	1.59 $\pm$ 0.06 CM.	0.63 $\pm$ 0.02 IN.
MINIMUM	18.30 CM.	7.20 IN.
MAXIMUM	29.50 CM.	11.61 IN.
C.V.	7.20 %	7.20 %

	CM.	IN.	
1	18.63	7.34	
2	19.02	7.49	
3	19.28	7.59	
5	19.63	7.73	
10	20.18	7.94	
15	20.55	8.09	
P	20	20.85	8.21
E	25	21.10	8.31
R	30	21.33	8.40
C	35	21.53	8.48
E	40	21.73	8.56
N	45	21.92	8.63
T	50	22.11	8.70
I	55	22.30	8.78
L	60	22.49	8.85
E	65	22.68	8.93
S	70	22.90	9.01
	75	23.13	9.11
	80	23.39	9.21
	85	23.71	9.33
	90	24.13	9.50
	95	24.81	9.77
	97	25.29	9.96
	98	25.68	10.11
	99	26.35	10.37





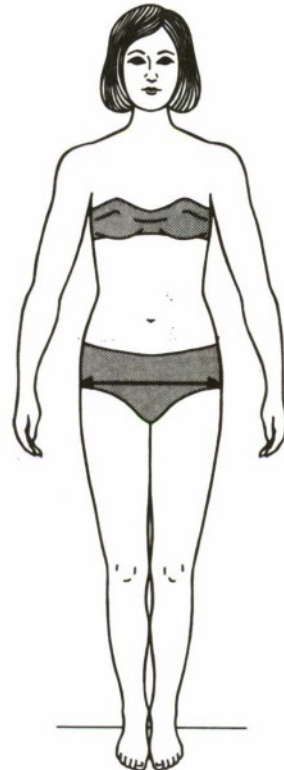
# HIP BREADTH, STANDING

Subject stands erect with weight evenly distributed on both feet.  
Using the anthropometer, measure the maximum transverse diameter of the hips.

N 422

MEAN	33.07 $\pm$ 0.07 CM.	13.02 $\pm$ 0.03 IN.
S.D.	1.47 $\pm$ 0.05 CM.	0.58 $\pm$ 0.02 IN.
MINIMUM	24.90 CM.	9.80 IN.
MAXIMUM	38.00 CM.	14.96 IN.
C.V.	4.44 %	4.44 %

	CM.	IN.
1	29.75	11.71
2	30.25	11.91
3	30.55	12.03
5	30.92	12.17
10	31.45	12.38
15	31.78	12.51
P	20	32.03
E	25	32.24
R	30	32.42
C	35	32.59
E	40	32.76
N	45	32.91
T	50	33.07
I	55	33.23
L	60	33.39
E	65	33.57
S	70	33.75
	75	33.97
	80	34.21
	85	34.51
	90	34.92
	95	35.60
	97	36.09
	98	36.49
	99	37.16



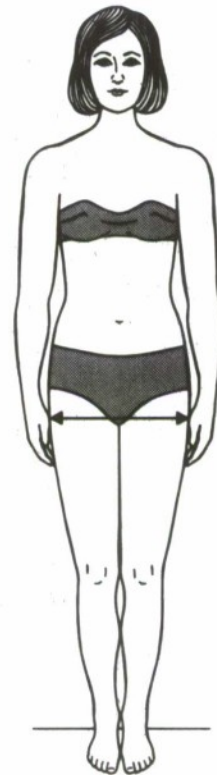
# BITROCHANTERIC BREADTH

Subject stands erect with feet together and weight evenly distributed on both feet. Using the anthropometer with firm pressure, measure the maximum transverse distance between the external surface of the greater trochanters.

N 406

MEAN	30.19 $\pm$ 0.07 CM.	11.89 $\pm$ 0.03 IN.
S.D.	1.38 $\pm$ 0.05 CM.	0.54 $\pm$ 0.02 IN.
MINIMUM	23.40 CM.	9.21 IN.
MAXIMUM	34.90 CM.	13.74 IN.
C.V.	4.57 %	4.57 %

		CM.	IN.
P E R C E N T I L E S	1	27.02	10.64
	2	27.46	10.81
	3	27.72	10.91
	5	28.07	11.05
	10	28.57	11.25
	15	28.90	11.38
	20	29.15	11.48
	25	29.36	11.56
	30	29.55	11.63
	35	29.72	11.70
	40	29.89	11.77
	45	30.04	11.83
	50	30.20	11.89
	55	30.36	11.95
	60	30.52	12.02
	65	30.69	12.08
	70	30.87	12.15
	75	31.07	12.23
	80	31.29	12.32
	85	31.57	12.43
	90	31.93	12.57
	95	32.51	12.80
	97	32.92	12.96
	98	33.24	13.09
	99	33.78	13.30



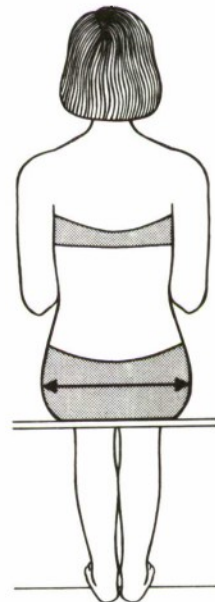
# HIP BREADTH, SITTING

Subject sits erect with knees together and feet resting lightly on footrest. Using the anthropometer, measure horizontally across the widest protrusions of the hips.

N 422

MEAN	36.82 $\pm$ 0.09 CM.	14.50 $\pm$ 0.03 IN.
S.D.	1.79 $\pm$ 0.06 CM.	0.70 $\pm$ 0.02 IN.
MINIMUM	32.20 CM.	12.68 IN.
MAXIMUM	42.00 CM.	16.54 IN.
C.V.	4.85 %	4.85 %

	CM.	IN.
	1 32.73	12.89
	2 33.12	13.04
	3 33.40	13.15
	5 33.81	13.31
	10 34.50	13.58
	15 34.98	13.77
P	20 35.36	13.92
E	25 35.68	14.05
R	30 35.96	14.16
C	35 36.22	14.26
E	40 36.46	14.36
N	45 36.69	14.45
T	50 36.92	14.53
I	55 37.13	14.62
L	60 37.35	14.71
E	65 37.57	14.79
S	70 37.80	14.88
	75 38.05	14.98
	80 38.33	15.09
	85 38.65	15.22
	90 39.07	15.38
	95 39.75	15.65
	97 40.24	15.84
	98 40.64	16.00
	99 41.36	16.28



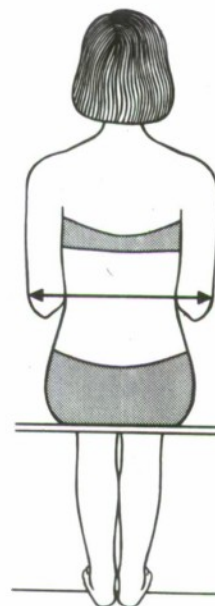
# ELBOW-ELBOW BREADTH

Subject sits erect with feet resting lightly on footrest, upper arms hanging at her sides, lower arms extended forward horizontally, and elbows against her body. Using the anthropometer with firm pressure, measure the maximum horizontal distance across the lateral surfaces of the elbows.

N 423

MEAN	33.00 $\pm$ 0.11 CM.	12.99 $\pm$ 0.04 IN.
S.D.	2.32 $\pm$ 0.08 CM.	0.91 $\pm$ 0.03 IN.
MINIMUM	27.00 CM.	10.63 IN.
MAXIMUM	39.90 CM.	15.71 IN.
C.V.	7.03 %	7.03 %

	CM.	IN.
	1 28.06	11.05
	2 28.67	11.29
	3 29.03	11.43
	5 29.51	11.62
	10 30.21	11.89
	15 30.69	12.08
P	20 31.07	12.23
E	25 31.41	12.37
R	30 31.72	12.49
C	35 32.02	12.61
E	40 32.31	12.72
N	45 32.60	12.83
T	50 32.89	12.95
I	55 33.19	13.07
L	60 33.49	13.19
E	65 33.82	13.32
S	70 34.18	13.45
	75 34.57	13.61
	80 35.01	13.78
	85 35.54	13.99
	90 36.22	14.26
	95 37.22	14.65
	97 37.86	14.90
	98 38.31	15.08
	99 38.99	15.35



# KNEE-KNEE BREADTH, SITTING

Subject sits erect with knees touching and feet resting on a surface adjusted so that her knees are bent at about right angles. Using the anthropometer, measure the maximum horizontal distance across the lateral surfaces of the knees.

N 423

MEAN	17.73 ± 0.04 CM.	6.98 ± 0.02 IN.
S.D.	0.85 ± 0.03 CM.	0.34 ± 0.01 IN.
MINIMUM	15.40 CM.	6.06 IN.
MAXIMUM	20.80 CM.	8.19 IN.
C.V.	4.80 %	4.80 %

	CM.	IN.
	1 15.98	6.29
	2 16.11	6.34
	3 16.21	6.38
	5 16.37	6.44
	10 16.63	6.55
	15 16.82	6.62
P	20 16.98	6.68
E	25 17.11	6.74
R	30 17.24	6.79
C	35 17.35	6.83
E	40 17.46	6.87
N	45 17.56	6.91
T	50 17.67	6.95
I	55 17.77	7.00
L	60 17.87	7.04
E	65 17.98	7.08
S	70 18.10	7.13
	75 18.23	7.18
	80 18.38	7.23
	85 18.55	7.30
	90 18.79	7.40
	95 19.18	7.55
	97 19.46	7.66
	98 19.69	7.75
	99 20.10	7.91





# HUMERAL EPICONDYLAR BREADTH

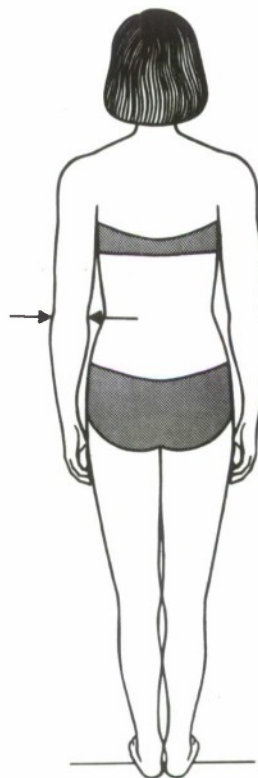
Subject stands with upper arm slightly abducted and elbow flexed. Using the sliding caliper with maximum pressure to compress the flesh, measure the distance between the medial and lateral epicondyles of the left humerus.

N 422

MEAN	6.06 $\pm$ 0.02 CM.	2.39 $\pm$ 0.01 IN.
S.D.	0.31 $\pm$ 0.01 CM.	0.12 $\pm$ 0.00 IN.
MINIMUM	5.00 CM.	1.97 IN.
MAXIMUM	7.00 CM.	2.76 IN.
C.V.	5.11 %	5.11 %

	CM.	IN.
1	5.29	2.08
2	5.42	2.13
3	5.49	2.16
5	5.57	2.19
10	5.68	2.24
15	5.75	2.26
20	5.80	2.28
25	5.84	2.30
30	5.89	2.32
35	5.93	2.33
40	5.97	2.35
45	6.01	2.36
50	6.05	2.38
55	6.09	2.40
60	6.13	2.41
65	6.18	2.43
70	6.23	2.45
75	6.29	2.48
80	6.35	2.50
85	6.42	2.53
90	6.52	2.57
95	6.64	2.61
97	6.70	2.64
98	6.74	2.65
99	6.77	2.66

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# WRIST BREADTH

Subject stands with arm slightly abducted. Using the sliding caliper with firm pressure, measure the distance between the radial and ulnar styloid prominences of the left wrist.

N 422

MEAN	5.03 $\pm$ 0.01 CM.	1.98 $\pm$ 0.01 IN.
S.D.	0.27 $\pm$ 0.01 CM.	0.11 $\pm$ 0.00 IN.
MINIMUM	4.20 CM.	1.65 IN.
MAXIMUM	5.80 CM.	2.28 IN.
C.V.	5.38 %	5.38 %

		CM.	IN.
	1	4.27	1.68
	2	4.40	1.73
	3	4.48	1.76
	5	4.57	1.80
	10	4.70	1.85
	15	4.78	1.88
P	20	4.83	1.90
E	25	4.88	1.92
R	30	4.92	1.94
C	35	4.96	1.95
E	40	4.99	1.96
N	45	5.02	1.98
T	50	5.05	1.99
I	55	5.08	2.00
L	60	5.12	2.01
E	65	5.15	2.03
S	70	5.18	2.04
	75	5.22	2.06
	80	5.26	2.07
	85	5.32	2.09
	90	5.39	2.12
	95	5.50	2.16
	97	5.57	2.19
	98	5.63	2.22
	99	5.73	2.26



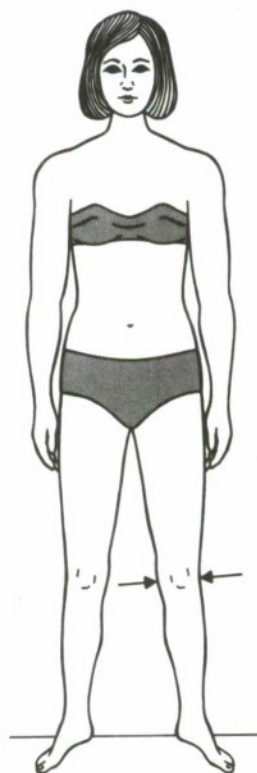
# FEMORAL BICONDYLAR BREADTH

Subject stands erect with left leg slightly flexed. Using the sliding caliper with very firm contact, measure the transverse distance between the lateral and medial femoral epicondyles.

N 421

MEAN	8.86 $\pm$ 0.02 CM.	3.49 $\pm$ 0.01 IN.
S.D.	0.39 $\pm$ 0.01 CM.	0.15 $\pm$ 0.01 IN.
MINIMUM	7.80 CM.	3.07 IN.
MAXIMUM	10.10 CM.	3.98 IN.
C.V.	4.40 %	4.40 %

	CM.	IN.	
1	8.00	3.15	
2	8.10	3.19	
3	8.17	3.22	
5	8.26	3.25	
10	8.41	3.31	
15	8.51	3.35	
P	20	8.58	3.38
E	25	8.65	3.41
R	30	8.71	3.43
C	35	8.76	3.45
E	40	8.81	3.47
N	45	8.86	3.49
T	50	8.91	3.51
I	55	8.96	3.53
L	60	9.01	3.55
E	65	9.06	3.57
S	70	9.11	3.59
	75	9.17	3.61
	80	9.23	3.64
	85	9.31	3.66
	90	9.40	3.70
	95	9.55	3.76
	97	9.65	3.80
	98	9.72	3.83
	99	9.85	3.88



## CHEST DEPTH

Subject stands erect with arms relaxed. Using the anthropometer, measure the horizontal depth of the chest at the level of the inferior margin of the xiphoid process.

N 404

MEAN	16.60 $\pm$ 0.06 CM.	6.54 $\pm$ 0.02 IN.
S.D.	1.22 $\pm$ 0.04 CM.	0.48 $\pm$ 0.02 IN.
MINIMUM	13.70 CM.	5.39 IN.
MAXIMUM	20.20 CM.	7.95 IN.
C.V.	7.36 %	7.36 %

		CM.	IN.
P E R C E N T I L E S	1	14.22	5.60
	2	14.38	5.66
	3	14.51	5.71
	5	14.71	5.79
	10	15.06	5.93
	15	15.32	6.03
	20	15.53	6.12
	25	15.72	6.19
	30	15.90	6.26
	35	16.06	6.32
	40	16.22	6.38
	45	16.37	6.44
	50	16.52	6.50
	55	16.67	6.56
	60	16.83	6.63
	65	16.99	6.69
	70	17.16	6.76
	75	17.35	6.83
	80	17.57	6.92
	85	17.82	7.02
	90	18.16	7.15
	95	18.69	7.36
	97	19.07	7.51
	98	19.36	7.62
	99	19.87	7.82



# WAIST DEPTH

Subject stands erect with abdomen relaxed. Using the anthropometer, measure the horizontal depth of the abdomen at the level of minimum waist circumference. The subject is instructed not to contract her abdominal musculature.

N 393

MEAN	14.79 $\pm$ 0.05 CM.	5.82 $\pm$ 0.02 IN.
S.D.	1.05 $\pm$ 0.04 CM.	0.41 $\pm$ 0.01 IN.
MINIMUM	12.10 CM.	4.76 IN.
MAXIMUM	18.10 CM.	7.13 IN.
C.V.	7.08 %	7.08 %

	CM.	IN.
1	12.52	4.93
2	12.71	5.00
3	12.85	5.06
5	13.07	5.15
10	13.44	5.29
15	13.70	5.40
20	13.92	5.48
25	14.10	5.55
30	14.26	5.62
35	14.42	5.68
40	14.56	5.73
45	14.69	5.78
50	14.83	5.84
55	14.96	5.89
60	15.09	5.94
65	15.23	5.99
70	15.37	6.05
75	15.52	6.11
80	15.69	6.18
85	15.88	6.25
90	16.13	6.35
95	16.53	6.51
97	16.80	6.61
98	17.02	6.70
99	17.40	6.85

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## BUTTOCKS DEPTH

Subject stands erect. Using the anthropometer, measure the horizontal distance between the anterior surface of the abdomen and the buttocks at the level of maximum posterior protrusion.

N 421

MEAN	20.38 $\pm$ 0.05 CM.	8.03 $\pm$ 0.02 IN.
S.D.	1.02 $\pm$ 0.04 CM.	0.40 $\pm$ 0.01 IN.
MINIMUM	17.50 CM.	6.89 IN.
MAXIMUM	23.20 CM.	9.13 IN.
C. V.	4.99 %	4.99 %

	CM.	IN.
	1 18.18	7.16
	2 18.42	7.25
	3 18.57	7.31
	5 18.77	7.39
	10 19.09	7.52
	15 19.31	7.60
P	20 19.49	7.67
E	25 19.65	7.73
R	30 19.79	7.79
C	35 19.92	7.84
E	40 20.05	7.89
N	45 20.18	7.94
T	50 20.31	7.99
I	55 20.44	8.05
L	60 20.57	8.10
E	65 20.71	8.15
S	70 20.86	8.21
	75 21.02	8.28
	80 21.21	8.35
	85 21.42	8.43
	90 21.70	8.54
	95 22.12	8.71
	97 22.38	8.81
	98 22.58	8.89
	99 22.87	9.01





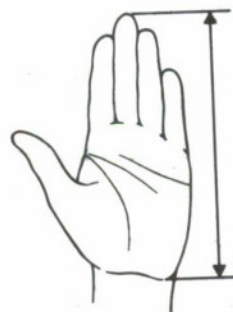
# HAND LENGTH

Subject extends her left hand with the palm upward and fingers together. Using the sliding caliper with the bar parallel to the long axis of the hand, measure the distance from the proximal edge of the navicular bone to the tip of the middle finger.

N 423

MEAN	17.33 $\pm$ 0.04 CM.	6.82 $\pm$ 0.02 IN.
S.D.	0.79 $\pm$ 0.03 CM.	0.31 $\pm$ 0.01 IN.
MINIMUM	15.20 CM.	5.98 IN.
MAXIMUM	19.50 CM.	7.68 IN.
C.V.	4.58 %	4.58 %

		CM.	IN.
P E R C E N T I L E S	1	15.47	6.09
	2	15.66	6.16
	3	15.78	6.21
	5	15.96	6.28
	10	16.25	6.40
	15	16.45	6.48
	20	16.61	6.54
	25	16.75	6.60
	30	16.88	6.64
	35	17.00	6.69
	40	17.11	6.73
	45	17.21	6.78
	50	17.32	6.82
	55	17.42	6.86
	60	17.53	6.90
	65	17.63	6.94
	70	17.75	6.99
	75	17.86	7.03
	80	18.00	7.08
	85	18.14	7.14
	90	18.33	7.22
	95	18.59	7.32
	97	18.75	7.38
	98	18.86	7.43
	99	19.04	7.50



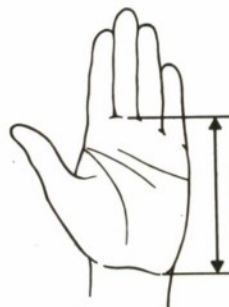
# PALM LENGTH

Subject extends her left hand with the palm upward and fingers together. Using the sliding caliper with the bar parallel to the long axis of the hand, measure the distance from the proximal edge of the navicular bone to the skin furrow formed where the middle finger folds upon the palm.

N 423

MEAN	9.68 $\pm$ 0.03 CM.	3.81 $\pm$ 0.01 IN.
S.D.	0.54 $\pm$ 0.02 CM.	0.21 $\pm$ 0.01 IN.
MINIMUM	8.20 CM.	3.23 IN.
MAXIMUM	11.10 CM.	4.37 IN.
C.V.	5.56 %	5.56 %

		CM.	IN.
P E R C E N T I L E S	1	8.36	3.29
	2	8.53	3.36
	3	8.63	3.40
	5	8.77	3.45
	10	8.99	3.54
	15	9.14	3.60
	20	9.25	3.64
	25	9.35	3.68
	30	9.44	3.72
	35	9.52	3.75
	40	9.59	3.78
	45	9.67	3.81
	50	9.74	3.83
	55	9.81	3.86
	60	9.88	3.89
	65	9.95	3.92
	70	10.02	3.95
	75	10.11	3.98
	80	10.20	4.01
	85	10.30	4.05
	90	10.43	4.11
	95	10.62	4.18
	97	10.74	4.23
	98	10.84	4.27
	99	10.98	4.32



# HAND BREADTH

Subject extends her left hand with the palm upward and fingers together and the thumb held away from the hand. Using the sliding caliper, measure the distance across the distal ends of the metacarpal bones.

N 423

MEAN	7.37 $\pm$ 0.02 CM.	2.90 $\pm$ 0.01 IN.
S.D.	0.32 $\pm$ 0.01 CM.	0.13 $\pm$ 0.00 IN.
MINIMUM	6.50 CM.	2.56 IN.
MAXIMUM	8.40 CM.	3.31 IN.
C.V.	4.37 %	4.37 %

	CM.	IN.
	6.56	2.58
	6.67	2.63
	6.74	2.65
	6.82	2.69
	6.95	2.73
	7.02	2.77
	7.08	2.79
	7.13	2.81
	7.18	2.83
	7.22	2.84
	7.26	2.86
	7.30	2.88
	7.34	2.89
	7.38	2.91
	7.43	2.92
	7.47	2.94
	7.52	2.96
	7.57	2.98
	7.63	3.00
	7.70	3.03
	7.80	3.07
	7.95	3.13
	8.05	3.17
	8.12	3.20
	8.24	3.24

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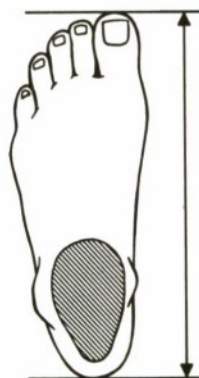
## FOOT LENGTH

Subject stands with her feet about 12 inches apart and weight evenly distributed. Holding the sliding caliper parallel to the long axis of the foot, measure the distance between the most posterior point on the heel to the most anterior point on the longest toe.

N 422

MEAN	23.87 $\pm$ 0.05 CM.	9.40 $\pm$ 0.02 IN.
S.D.	1.05 $\pm$ 0.04 CM.	0.41 $\pm$ 0.01 IN.
MINIMUM	20.50 CM.	8.07 IN.
MAXIMUM	27.50 CM.	10.83 IN.
C.V.	4.41 %	4.41 %

		CM.	IN.
P E R C E N T I L E S	1	21.51	8.47
	2	21.77	8.57
	3	21.94	8.64
	5	22.17	8.73
	10	22.52	8.86
	15	22.76	8.96
	20	22.95	9.03
	25	23.12	9.10
	30	23.27	9.16
	35	23.41	9.22
	40	23.55	9.27
	45	23.68	9.32
	50	23.81	9.38
	55	23.95	9.43
	60	24.09	9.48
	65	24.23	9.54
	70	24.38	9.60
	75	24.54	9.66
	80	24.73	9.73
	85	24.94	9.82
	90	25.20	9.92
	95	25.58	10.07
	97	25.82	10.17
	98	25.99	10.23
	99	26.23	10.33



# FOOT BREADTH

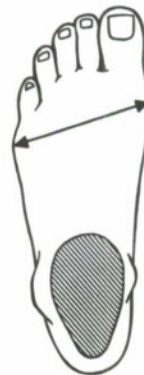
Subject stands with her feet about 12 inches apart and weight evenly distributed. Holding the sliding calipers perpendicular to the anterior-posterior axis of the foot, measure the maximum distance across the metatarsal-phalangeal joints.

N 422

MEAN	8.81 $\pm$ 0.02 CM.	3.47 $\pm$ 0.01 IN.
S.D.	0.47 $\pm$ 0.02 CM.	0.18 $\pm$ 0.01 IN.
MINIMUM	7.50 CM.	2.95 IN.
MAXIMUM	10.50 CM.	4.13 IN.
C.V.	5.29 %	5.29 %

	CM.	IN.
1	7.67	3.02
2	7.83	3.08
3	7.92	3.12
5	8.04	3.16
10	8.21	3.23
15	8.32	3.28
20	8.40	3.31
25	8.47	3.34
30	8.54	3.36
35	8.60	3.38
40	8.65	3.41
45	8.71	3.43
50	8.76	3.45
55	8.82	3.47
60	8.87	3.49
65	8.93	3.52
70	9.00	3.54
75	9.07	3.57
80	9.15	3.60
85	9.25	3.64
90	9.38	3.69
95	9.58	3.77
97	9.72	3.83
98	9.83	3.87
99	10.00	3.94

P  
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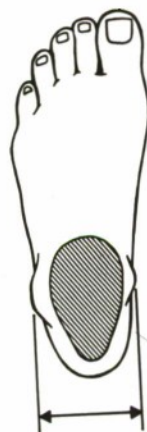
# BIMALLEOLAR BREADTH

Subject stands with her legs slightly apart and weight equally distributed on both feet. Holding the sliding caliper perpendicular to the long axis of the left foot, measure horizontally across the maximum protrusions of the medial and lateral malleoli.

N 406

MEAN	6.28 $\pm$ 0.01 CM.	2.47 $\pm$ 0.01 IN.
S.D.	0.29 $\pm$ 0.01 CM.	0.11 $\pm$ 0.00 IN.
MINIMUM	5.10 CM.	2.01 IN.
MAXIMUM	7.10 CM.	2.80 IN.
C.V.	4.61 %	4.61 %

		CM.	IN.
P E R C E N T I L E S	1	5.62	2.21
	2	5.72	2.25
	3	5.77	2.27
	5	5.85	2.30
	10	5.96	2.35
	15	6.04	2.38
	20	6.09	2.40
	25	6.14	2.42
	30	6.19	2.44
	35	6.23	2.45
	40	6.26	2.47
	45	6.30	2.48
	50	6.33	2.49
	55	6.37	2.51
	60	6.40	2.52
	65	6.44	2.54
	70	6.48	2.55
	75	6.52	2.57
	80	6.57	2.59
	85	6.63	2.61
	90	6.70	2.64
	95	6.80	2.68
	97	6.87	2.71
	98	6.93	2.73
	99	7.01	2.76





## HEAD LENGTH

Subject sits. Holding the spreading caliper near the tips, measure the maximum length of the head between the glabella and the occiput.

N 417

MEAN	185.20 $\pm$ 0.31 MM.	7.29 $\pm$ 0.01 IN.
S.D.	6.24 $\pm$ 0.22 MM.	0.25 $\pm$ 0.01 IN.
MINIMUM	167.00 MM.	6.57 IN.
MAXIMUM	205.00 MM.	8.07 IN.
C.V.	3.37 %	3.37 %

	MM.	IN.
	1 171.49	6.75
	2 173.09	6.81
	3 174.11	6.85
	5 175.51	6.91
	10 177.70	7.00
	15 179.20	7.06
P	20 180.40	7.10
E	25 181.44	7.14
R	30 182.37	7.18
C	35 183.24	7.21
E	40 184.06	7.25
N	45 184.86	7.28
T	50 185.66	7.31
I	55 186.45	7.34
L	60 187.26	7.37
E	65 188.09	7.41
S	70 188.97	7.44
	75 189.91	7.48
	80 190.97	7.52
	85 192.18	7.57
	90 193.70	7.63
	95 195.90	7.71
	97 197.29	7.77
	98 198.28	7.81
	99 199.79	7.87



## HEAD BREADTH

Subject sits. Holding the spreading caliper near the tips, measure the maximum breadth of the head in a line perpendicular to the mid-sagittal plane.

N 418

MEAN 145.42  $\pm$  0.25 MM. 5.73  $\pm$  0.01 IN.

S.D. 5.04  $\pm$  0.17 MM. 0.20  $\pm$  0.01 IN.

MINIMUM 131.00 MM. 5.16 IN.

MAXIMUM 161.00 MM. 6.34 IN.

C.V. 3.46 % 3.46 %

	MM.	IN.
	1 134.68	5.30
	2 136.06	5.36
	3 136.90	5.39
	5 138.00	5.43
	10 139.66	5.50
	15 140.77	5.54
P	20 141.65	5.58
E	25 142.43	5.61
R	30 143.14	5.64
C	35 143.80	5.66
E	40 144.44	5.69
N	45 145.07	5.71
T	50 145.70	5.74
I	55 146.34	5.76
L	60 147.00	5.79
E	65 147.69	5.81
S	70 148.43	5.84
	75 149.24	5.88
	80 150.16	5.91
	85 151.23	5.95
	90 152.59	6.01
	95 154.58	6.09
	97 155.83	6.13
	98 156.72	6.17
	99 158.03	6.22



# MINIMUM FRONTAL HEAD BREADTH

Subject sits. Holding the spreading caliper near the tips, measure the minimum horizontal distance between the greatest indentation of the temporal crests.

N 423

MEAN	107.28 ± 0.21 MM.	4.22 ± 0.01 IN.
S.D.	4.36 ± 0.15 MM.	0.17 ± 0.01 IN.
MINIMUM	95.00 MM.	3.74 IN.
MAXIMUM	123.00 MM.	4.84 IN.
C.V.	4.07 %	4.07 %

	MM.	IN.
	1 98.49	3.88
	2 99.52	3.92
	3 100.16	3.94
	5 101.03	3.98
	10 102.38	4.03
	15 103.32	4.07
P	20 104.07	4.10
E	25 104.74	4.12
R	30 105.35	4.15
C	35 105.92	4.17
E	40 106.47	4.19
N	45 107.02	4.21
T	50 107.56	4.23
I	55 108.12	4.26
L	60 108.69	4.28
E	65 109.29	4.30
S	70 109.93	4.33
	75 110.63	4.36
	80 111.43	4.39
	85 112.36	4.42
	90 113.55	4.47
	95 115.32	4.54
	97 116.46	4.59
	98 117.29	4.62
	99 118.55	4.67



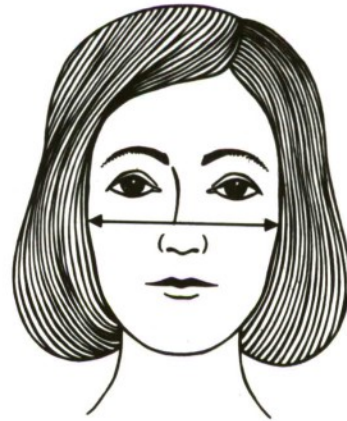
# BIZYGOMATIC BREADTH

Subject sits. Holding the spreading caliper near the tips, measure the maximum horizontal breadth of the face across the zygomatic arches.

N 423

MEAN	128.69 ± 0.21 MM.	5.07 ± 0.01 IN.
S.D.	4.39 ± 0.15 MM.	0.17 ± 0.01 IN.
MINIMUM	116.00 MM.	4.57 IN.
MAXIMUM	141.00 MM.	5.55 IN.
C.V.	3.41 %	3.41 %

	MM.	IN.
	1 119.28	4.70
	2 120.28	4.74
	3 120.96	4.76
	5 121.94	4.80
	10 123.52	4.86
	15 124.61	4.91
P	20 125.48	4.94
E	25 126.24	4.97
R	30 126.91	5.00
C	35 127.52	5.02
E	40 128.11	5.04
N	45 128.67	5.07
T	50 129.22	5.09
I	55 129.76	5.11
L	60 130.31	5.13
E	65 130.88	5.15
S	70 131.48	5.18
	75 132.12	5.20
	80 132.84	5.23
	85 133.68	5.26
	90 134.76	5.31
	95 136.43	5.37
	97 137.57	5.42
	98 138.46	5.45
	99 139.96	5.51



# BIGONIAL BREADTH

Subject sits. Holding the spreading caliper near the tips and using firm contact, measure the maximum horizontal width of the jaw across the gonial angles.

N 422

MEAN	97.14 $\pm$ 0.21 MM.	3.82 $\pm$ 0.01 IN.
S.D.	4.23 $\pm$ 0.15 MM.	0.17 $\pm$ 0.01 IN.
MINIMUM	85.00 MM.	3.35 IN.
MAXIMUM	113.00 MM.	4.45 IN.
C.V.	4.36 %	4.36 %

		MM.	IN.
P E R C E N T I L E S	1	88.92	3.50
	2	89.61	3.53
	3	90.12	3.55
	5	90.90	3.58
	10	92.24	3.63
	15	93.20	3.67
	20	93.99	3.70
	25	94.69	3.73
	30	95.32	3.75
	35	95.91	3.78
	40	96.46	3.80
	45	97.00	3.82
	50	97.54	3.84
	55	98.07	3.86
	60	98.61	3.88
	65	99.17	3.90
	70	99.76	3.93
	75	100.40	3.95
	80	101.11	3.98
	85	101.94	4.01
	90	103.00	4.05
	95	104.61	4.12
	97	105.69	4.16
	98	106.53	4.19
	99	107.91	4.25



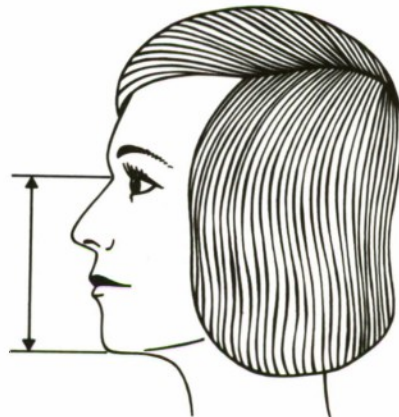
# TOTAL FACE HEIGHT

Subject sits. Using the sliding caliper, measure the vertical distance from menton to nasion.

N 423

MEAN	110.36 ± 0.24 MM.	4.34 ± 0.01 IN.
S.D.	4.92 ± 0.17 MM.	0.19 ± 0.01 IN.
MINIMUM	97.00 MM.	3.82 IN.
MAXIMUM	127.00 MM.	5.00 IN.
C.V.	4.46 %	4.46 %

	MM.	IN.
	1 98.65	3.88
	2 100.13	3.94
	3 101.09	3.98
	5 102.40	4.03
	10 104.41	4.11
	15 105.75	4.16
P	20 106.78	4.20
E	25 107.66	4.24
R	30 108.42	4.27
C	35 109.12	4.30
E	40 109.77	4.32
N	45 110.39	4.35
T	50 110.99	4.37
I	55 111.59	4.39
L	60 112.18	4.42
E	65 112.79	4.44
S	70 113.43	4.47
	75 114.11	4.49
	80 114.88	4.52
	85 115.77	4.56
	90 116.92	4.60
	95 118.72	4.67
	97 119.97	4.72
	98 120.97	4.76
	99 122.66	4.83





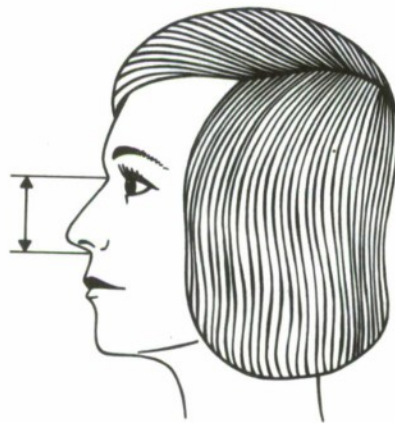
# NASAL HEIGHT

Subject sits. Using the sliding caliper, measure the vertical distance from subnasale to nasion.

N 423

MEAN	47.49 $\pm$ 0.16 MM.	1.87 $\pm$ 0.01 IN.
S.D.	3.24 $\pm$ 0.11 MM.	0.13 $\pm$ 0.00 IN.
MINIMUM	37.00 MM.	1.46 IN.
MAXIMUM	56.00 MM.	2.20 IN.
C.V.	6.82 %	6.82 %

	MM.	IN.
	1 40.61	1.60
	2 41.37	1.63
	3 41.87	1.65
	5 42.59	1.68
	10 43.75	1.72
	15 44.56	1.75
P	20 45.21	1.78
E	25 45.77	1.80
R	30 46.27	1.82
C	35 46.74	1.84
E	40 47.18	1.86
N	45 47.60	1.87
T	50 48.02	1.89
I	55 48.44	1.91
L	60 48.86	1.92
E	65 49.29	1.94
S	70 49.75	1.96
	75 50.23	1.98
	80 50.78	2.00
	85 51.40	2.02
	90 52.17	2.05
	95 53.32	2.10
	97 54.06	2.13
	98 54.60	2.15
	99 55.47	2.18



# NASAL BREADTH

Subject sits. Using the sliding caliper, measure the maximum horizontal breadth of the nose.

N 422

MEAN	31.64 $\pm$ 0.14 MM.	1.25 $\pm$ 0.01 IN.
S.D.	2.93 $\pm$ 0.10 MM.	0.12 $\pm$ 0.00 IN.
MINIMUM	25.00 MM.	0.98 IN.
MAXIMUM	43.00 MM.	1.69 IN.
C.V.	9.24 %	9.24 %

	MM.	IN.
	1 26.16	1.03
	2 26.80	1.06
	3 27.21	1.07
	5 27.78	1.09
	10 28.66	1.13
	15 29.26	1.15
P	20 29.74	1.17
E	25 30.16	1.19
R	30 30.53	1.20
C	35 30.88	1.22
E	40 31.22	1.23
N	45 31.55	1.24
T	50 31.88	1.26
I	55 32.22	1.27
L	60 32.58	1.28
E	65 32.95	1.30
S	70 33.36	1.31
	75 33.82	1.33
	80 34.36	1.35
	85 35.02	1.38
	90 35.92	1.41
	95 37.43	1.47
	97 38.55	1.52
	98 39.45	1.55
	99 41.02	1.61



## APPENDIX A

### APPLICABILITY OF DATA OF STEWARDESSES OF OTHER AIRLINES

Although all airlines recruit stewardesses from the same general population of young females, each has its own selection standards for age, height, weight, education, and other variables. Therefore, we might expect the stewardess complement of each airline to be anthropometrically unique--a factor to be considered in the application of the present data taken from a single airline to the stewardess population as a whole. For this reason, we have reviewed the selection criteria of the 55 United States, Canadian, and Caribbean air carriers. Users of this report, when applying our data to stewardesses of particular airlines, should take such differences into account.

Age. Airlines vary in both minimum and maximum age requirements for stewardess trainees. Age minimums vary from 19 to 21 years; most require that an applicant be at least 20 years old when she enters training. Maximum ages for acceptance for training, when specified, range from 25 to 28 years. Many airlines, however, stipulate no maximum age. American Airlines accepts trainees as young as 19.5 years old and has no stated maximum but prefers that an applicant be less than 28 years old.

Table A-1 shows minimum and maximum age requirements in terms of percentage of stewardesses employed. About 38 percent of all currently employed stewardesses work for airlines with acceptance age requirements similar to those of American Airlines.

TABLE A-1

PERCENTAGES OF STEWARDESSES EMPLOYED BY 55 UNITED STATES,  
CANADIAN, AND CARIBBEAN AIRLINES IN RELATION TO 1971  
MINIMUM AND MAXIMUM RECRUITING AGE LIMITS

	Maximum Age					Total
	25	26	27	28*	Over 28	
19	2.77	1.09	1.05	0.68	1.59	7.18
19.5*	0.00	0.00	0.00	0.00	37.98	37.98
20	4.28	9.75	1.11	0.15	35.25	50.54
21	0.00	0.50	1.06	0.89	1.85	4.30
Total	7.05	11.34	3.22	1.72	76.67	100.00

\*American Airlines age limits.

Height. All airlines use minimum and maximum height limitations in selection of stewardesses. In most, for example, 5 feet 2 inches is considered the minimum height for an applicant. Some airlines, however, recruit girls as short as 5 feet 1 inch and one (Air West) takes girls as short as 5 feet.\* At the other extreme, several will not accept applicants shorter than 5 feet 3 inches and, recently, Northwest Orient raised its minimum to 5 feet 4 inches.

Maximum stature limits are more variable, ranging from 5 feet 5 inches to 6 feet with most airlines using 5 feet 9 inches as an upper limit.

\*A few small commuter airlines, because of limited head room of the smaller aircraft, employ "mini" stewardesses ranging from 4 feet 5 inches to 4 feet 11 inches in stature.

TABLE A-2

PERCENTAGES OF STEWARDESSES EMPLOYED BY 55 MAJOR UNITED STATES,  
CANADIAN, AND CARIBBEAN AIRLINES IN RELATION TO 1971  
MINIMUM AND MAXIMUM HEIGHT LIMITS

Minimum Height	Maximum Height								
	5'5"	5'6"	5'7"	5'8"	5'9"	*5'10"	5'11"	6'0"	Total
5'0"	0.00	0.00	0.00	0.33	0.92	0.00	0.00	0.00	1.25
5'1"	0.00	0.00	0.13	0.19	1.26	0.26	0.00	0.00	1.84
5'2"*	0.05	0.31	1.13	15.15	31.61	25.12	0.00	0.00	73.37
5'3"	0.00	0.00	0.46	0.00	17.61	0.10	0.00	0.00	18.17
5'4"	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.37	5.37
Total	0.05	0.31	1.72	15.67	51.40	25.48	0.00	5.37	100.00

\*American Airlines height limits.

Table A-2 combines the available data on minimum and maximum height limits in percentages of stewardesses employed by the 55 United States, Canadian and Caribbean carriers. From the table, it can be seen that 31.61 percent of the 42,000 currently employed stewardesses work for companies that recruit within the height ranges of 5 feet 2 inches to 5 feet 9 inches. American Airlines, which furnished our subjects, accepts applicants between 5 feet 2 inches and 5 feet 10 inches. Airlines using height standards identical to American's employ 25.12 percent of the North American stewardesses.



Weight. Only a few airlines specify minimum and maximum weights as recruiting limits. Instead, they maintain height-weight tables that specify a maximum weight for a given height. In some instances, a minimum weight for each height is also specified; in others, no minimums are specified, but presumably an applicant appearing abnormally thin for her height is subject to rejection by airline interviewers. Most airlines require that a stewardess maintain her "table weight" throughout her career. A few allow a slight increase (usually 2-5 pounds) after age 35.

The origins of these tables are not always clear. Some were apparently devised by airline health officials using various medical sources. Others were devised by stewardess training officials and are based merely on their general impression of the maximum weight at which a stewardess "looks good" for her height. The height-weight table of American Airlines is adopted from that of a well-known modeling agency. The tables of many smaller airlines were simply borrowed from their larger competitors (See Table A-2).

In Table A-3 are the height maximum and weight requirements for the 14 major airlines, which, together, employ more than 80 percent of the active stewardess population. Inspection of this table shows that among the airlines, the range of maximum allowable weights averages around 10 pounds for a given height category. For example, a 65-inch stewardess employed by CP Air may not exceed 120 pounds, while her twin, if employed by Continental, could weigh as much as 129 pounds.

Of the 14 major airlines employing 400 or more stewardesses, five (Northwest Orient, American, Delta, United, and Continental) do not



TABLE A-3  
WEIGHT MAXIMUM (POUNDS) FOR UNIT HEIGHT FOR 14 AIRLINES  
EMPLOYING 400 OR MORE STEWARDESSES

Airline	Height in inches													
	60	61	62	63	64	65	66	67	68	69	70	71	72	
CP Air				110	115	120	125	130	135	140	145	150	155	
National			109	114	116	120	123	128	135	140				
NW Orient					118	122	126	129	133	137	142	146	150	
American			108	112	118	122	128	132	138	142	145			
Pan American			110	115	120	125	130	135	138	140	145			
Delta			113	116	120	125	130	135	140					
Northeast			115	118	120	125	130	133	136	138				
Trans World			115	119	123	127	131	134	137	140				
Eastern			115	119	123	127	131	135	137	140				
Air Canada			115	119	123	127	131	135	137	140	145			
Braniff			115	119	124	128	132	136	140	145	150			
United			118	121	125	128	132	136	140	144				
Western			118	122	125	128	132	135	137	142	145			
Continental	104	109	114	119	124	129	134	139	144	147	150	153		
Range:	104-	109-	108-	110-	115-	120-	123-	128-	133-	137-	142-	150-	150-	
			118	122	125	129	134	139	144	147	150	153	155	
Difference:			10	12	10	9	11	11	11	10	8	7	5	

specify weight minimums. Two (National and Pan American) require a minimum weight of 100 pounds, regardless of stature. The remaining seven specify a minimum weight for each 1-inch increment in height; these minimums are given in Table A-4.

In contrast to weight maximum, in which interairline variability tends to be constant throughout the stature range, the variability for minimum weight increases with height. Thus, a 62-inch Western stewardess must maintain a weight of 100 pounds while a Braniff stewardess of the same height must maintain a weight of 105 pounds; at 70 inches, stewardesses of these same airlines must maintain minimum weights of 126 and 145 pounds, respectively.

Girth Measurements. In addition to height and weight limits, some airlines specify a maximum hip girth which stewardesses of a given height may not exceed. Of the large 14 airlines, only three have such specifications (Table A-5). Several others specify a maximum hip girth of 38 inches regardless of height or weight. A number of airlines merely note that an applicant's hip girth must be proportionate to her weight and height. Only National Airlines specified waist and bust measurements in addition to hip girth.

Marital Status. Most airlines, like American, hire single applicants only. With two exceptions (Delta and Pacific Western), divorcees are accepted if their divorces are final. Divorcees with dependents are accepted by Hughes Airwest and Northwest Orient. Five small airlines that have limited training facilities prefer to hire ex-stewardesses and will accept married applicants.

TABLE A-4  
SPECIFIED WEIGHT MINIMUM FOR SEVEN AIRLINES  
EMPLOYING 400 OR MORE STEWARDESSES

Airline	60	61	62	63	64	65	66	67	68	69	70	71	72
Northeast			101	105	108	111	115	118	121	125			
Western			100	105	108	111	114	118	122	124	126		
Trans World			100	104	108	112	116	120	122	124			
Eastern			100	104	108	112	116	120	122	124			
Air Canada			100	104	108	112	116	120	122	124	130		
CP Air				105	110	115	120	125	130	135	140	145	150
Braniff			105	109	113	119	124	130	135	140	145		
Range:	100- 105		104- 109	108- 113	111- 119	114- 124	118- 130	121- 135	124- 140	126- 145	---	---	---
Difference:	5	5	5	5	8	10	12	14	16	19	---	---	---

TABLE A-5  
MAXIMUM GIRTH MEASUREMENTS (INCHES) PER UNIT HEIGHT

Airline	60	61	62	63	64	65	66	67	68	69	70	71	72
<u>Northeastern</u>													
Hip Girth	---	---	34.0	34.0	35.0	36.0	36.0	37.0	38.0	38.0	---	---	---
<u>American</u>													
Hip Girth	---	---	35.0	35.0	36.0	37.0	37.0	37.0	38.0	38.0	38.0	---	---
<u>National</u>													
Hip Girth	---	---	34.5	35.0	35.5	36.0	36.5	36.75	37.0	37.5			
Waist Girth	---	---	22.5	23.0	23.5	24.0	24.5	25.0	25.5	26.0			
Bust Girth	---	---	32.0	33.0	33.5	34.0	35.0	35.5	36.0	36.5			

While several airlines do not retain a stewardess who marries after training, the majority allow post-training matrimony. An increasing number, including American Airlines, grant pregnancy leaves and retain a stewardess with children on flying status providing flight assignments and domiciles are not restricted by dependents.

Education. For all United States, Canadian, and Caribbean airlines, the minimal education requirements is a high school diploma or its equivalent. A number of companies indicate a preference for 2 years of college, although some type of public-oriented work experience may be substituted. Nine airlines make the 2 years of college a mandatory requirement. Four years of college or equivalent occupational experience is required by two airlines, Trans International and World Airways.

Citizenship Requirements. In the United States, four airlines (Airlift, Alaska, Seaboard World, and World Airways) have no citizenship requirements. One airline (Capital) will hire applicants who are not United States citizens if they are fluent in English and two other languages. The great majority of U. S. airlines will accept resident aliens who have permanent visas. A few (e.g., Frontier and Delta) require full U. S. citizenship. The most restrictive is Southern Airways, whose applicants must have been born or be currently residing in Southeastern United States.

All Canadian airlines except Quebecair require that applicants be Canadian citizens or landed immigrants. In the Caribbean, Air Jamaica and BWI restrict applicants to their own nationals. Air Bahama has no citizenship requirements.

Foreign Languages. The majority of U. S. airlines require no foreign language ability, but most stress that fluency in at least one language other than English is considered an asset in hiring. Of the airlines that do require an additional language, the choice reflects the region and foreign routes they serve. Thus, Caribbean demands that all its stewardesses be fluent in both English and Spanish. Hughes Airwest and Western require Spanish fluency only for stewardesses serving Mexican routes. New York Airlines, Pan American, and Trans International require one language in addition to English but do not specify any particular foreign language. National requires that stewardesses serving its overseas flights be fluent in both French and German as well as English.

Caribbean-based airlines require only English with the exception of Air Bahama, which specifies an additional language, preferably French or German.

In Canada, CP Air and Pacific Western require only English but indicate that any additional language is considered an asset in hiring. Air Canada requires that stewardesses on routes originating in Montreal speak both English and French fluently. Eastern Provincial and Nordair Canadian require that all stewardesses speak both English and French.



## REFERENCES

1. Snow, C. C., J. J. Carroll, and M. A. Allgood: Survival in Emergency Escape from Passenger Aircraft. FAA Office of Aviation Medicine Report No. AM 70-16, 1970.
2. National Transportation Safety Board. A Study of U. S. Air Carrier Accidents, 1964-1969. National Transportation Safety Board Report No. NTSB-AAS 72-5, 1972.
3. Mott, D. R., and B. J. Boadwine: Accident/Incident Research Summary. Steward and Stewardess Division of the Air Line Pilots Association, Engineering and Air Safety Department, Nov. 1970.
4. Bradley, J. V.: Distribution-Free Statistical Tests, Englewood Cliffs, New Jersey, Prentice Hall, Inc., 1968.
5. Hertzberg, H. T. E., G. S. Daniels, and E. Churchill: Anthropometry of Flying Personnel. WADC Technical Report No. 52-321, Wright Air Development Center, Air Research and Development Command, United States Air Force, Wright-Patterson Air Force Base, Ohio, 1954.
6. Hertzberg, H. T. E., E. Churchill, C. W. Dupertuis, R. M. White, and A. Damon: Anthropometric Survey of Turkey, Greece, and Italy. New York, Pergamon Press, Inc., 1963.
7. Clauser, C. E., P. E. Tucker, J. T. McConville, E. Churchill, L. L. Laubach, and J. A. Reardon: Anthropometry of Air Force Women. Aerospace Medical Research Laboratory, Aerospace Medical Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, National Technical Information Service, 1972.
8. U. S. Bureau of the Census. Statistical Abstract of the United States, 93rd Edition, Washington, D. C., 1972.

Department of Transportation, Federal Aviation Administration, Office of Aviation Medicine, Civil Aeromedical Institute, Oklahoma City, Oklahoma. **ANTHROPOMETRY OF AIRLINE STEWARDESSES** by C. C. Snow, H. M. Reynolds, and M. A. Allgood, 103 pp., Report No. FAA-AM-75-2

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